Published on the First of each month by MAGAZINES, Inc. 53 West Jackson Boulevard CHICAGO, Ill.

Established in 1880

Title Registered in U. S. Patent Office

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Entered as second class matter Oct. 17, 1917, at Post Office at Chicago, Ill., under Act of March 3, 1879.

THE NATIONAL FRUIT MAGAZINE OF AMERICA

AMERICAN FRUIT GROWER MAGAZINE

SUBSCRIPTION RATES

One year 50c. Three years $1. Five years $1.50. Foreign $1.00 per year

A Subscription Blank is enclosed in the last copy of the subscription period, and should be returned to this office promptly to insure uninterrupted delivery of your magazine.

ADVERTISING RATES

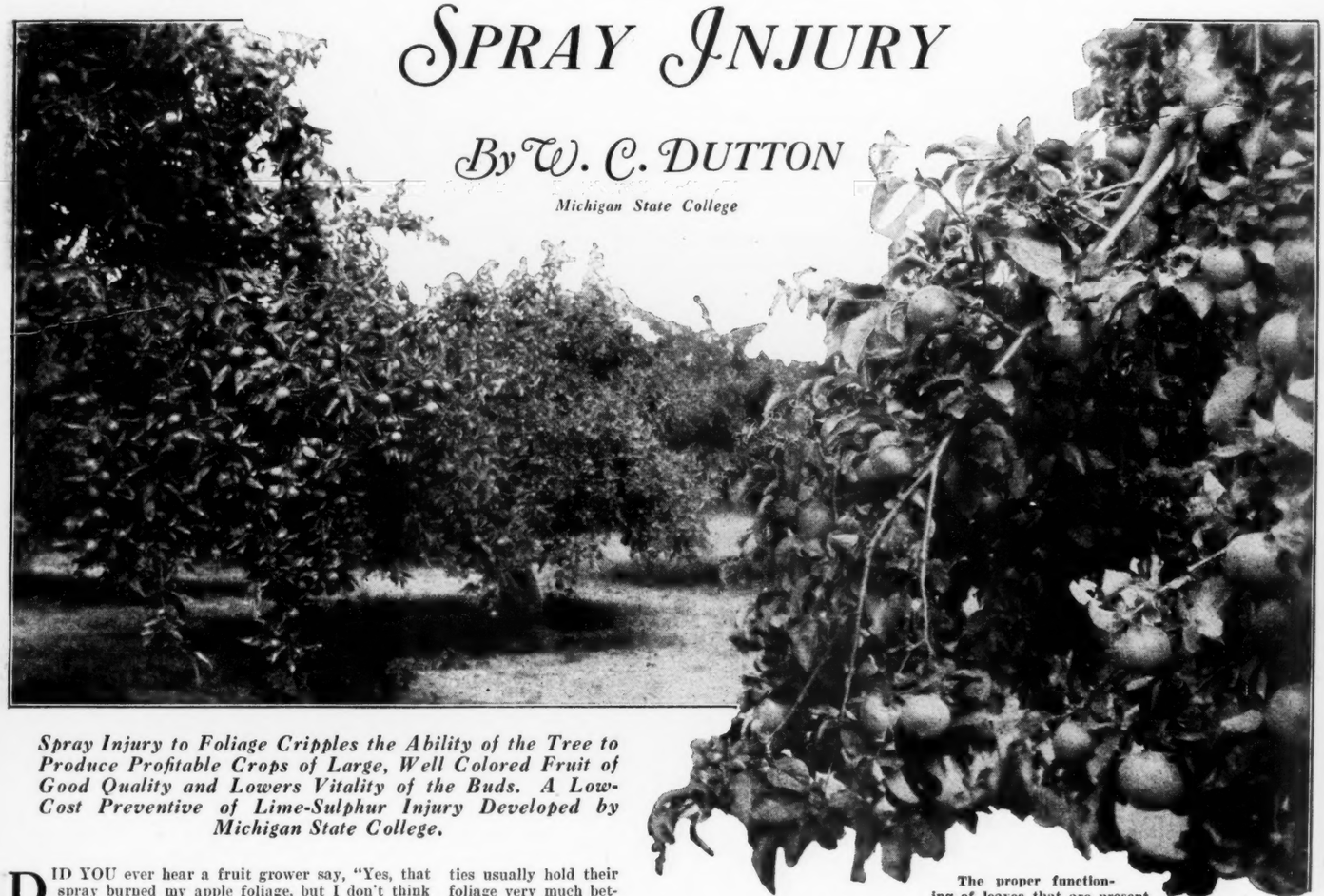
$2.25 per agate line flat. $31.50 per inch per insertion. Classified 15c word.

Volume XLIX FEBRUARY, 1929 Number 2

SULPHATE of IRON REDUCES SPRAY INJURY

By W. C. DUTTON

Michigan State College



Spray Injury to Foliage Cripples the Ability of the Tree to Produce Profitable Crops of Large, Well Colored Fruit of Good Quality and Lowers Vitality of the Buds. A Low-Cost Preventive of Lime-Sulphur Injury Developed by Michigan State College.

The proper functioning of leaves that are present in sufficient numbers is one of the necessary requirements for apples of good size, high color and marketable quality

DID YOU ever hear a fruit grower say, "Yes, that spray burned my apple foliage, but I don't think it will hurt anything"? I have heard that remark, and from men who are first-class growers in most respects. Fortunately, most growers now recognize the seriousness of injury to apple foliage by spraying materials, and in an effort to eliminate or reduce it, have frequently resorted to the use of materials that have been very unsatisfactory in other respects. It is doubtful, however, if the real significance of spray injury is realized by most growers.

Varietal Differences

There are several types of injury, but it is often difficult to distinguish between the various forms. Varieties differ widely in their response to spraying materials. McIntosh, for instance, may often be affected in one way by the lime-sulphur-lead arsenate spray, and Baldwin and Jonathan may show another type of injury. Most varieties, when sprayed with Bordeaux, show severe russeting of the fruit when the Bordeaux is used for all applications, but Northern Spy is quite resistant to russeting. There is even greater difference in the susceptibility of varieties to copper injury (Bordeaux injury) to the foliage. One variety may lose many leaves from copper injury under certain conditions, but most varieties usually hold their foliage very much better when sprayed with Bordeaux than when lime-sulphur is used. These statements concerning the development of injury from the different materials cannot be taken as absolute for all districts, as environmental factors have a definite bearing on what material or materials can be used.

Climatic Relations

Temperature and humidity are probably the most important determining factors. Lime-sulphur cannot be safely used in mid or late summer in districts where high temperatures prevail at that time. Bordeaux can be more safely used under such conditions, provided the humidity is not too great, but the combination of relatively high temperature and high humidity is very favorable to the development of copper injury on Bordeaux sprayed trees. The rate of drying of the spray mixture is also often an important factor where lime-sulphur is used. Other relations of the environment to spray injury could be enumerated, but those mentioned serve to show that the conditions responsible for, or connected with, injury are complex and often present difficulties that are not easy to overcome.

Why Is Foliage Injury Serious?

We have seen that there are many kinds of injury, that varieties differ in their susceptibility to injury, and that climatic conditions may play an important part in its development, but the real question is, "What does this all amount to, or why is the loss of some leaves and the injury to some of those that remain a cause for alarm?"

If you will consider for a moment what the leaf really does for the tree, I am sure you will conclude that the prevention of foliage injury is an important part of spraying manage- (*To Page* 32)

To Make a Stock Solution of Iron Sulphate

"For **each** 100 gallons of **diluted** lime-sulphur to be used in a spray operation, dissolve **one pound** of Iron Sulphate in water to make **one gallon.** Add **five quarts** of this iron sulphate dilution, when the sprayer tank is partly full of water, for each 100 gallons of tank capacity. Then, with agitation, add the lead arsenate, and when the tank is nearly full, add the lime-sulphur. Fill the tank to capacity with water and apply." **[The addition of iron sulphate to dry lime-sulphur dilution is unnecessary.—Ed.]**

How Shawnee Saved Her Trees

This Community Spray Ring Provided Good Commercial Control for Nearly 16,000 Orchard Trees at a Cost of Slightly Over $1000.00

By MAX WOLF

THE ORGANIZATION of a large co-operative spray ring, the one operating at Shawnee Mission, Kan., came about as a matter of necessity. A state inspector had served written notice on fruit growers in the community that unless their apple trees were rid of San Jose scale immediately the trees would be condemned and burned. The result of this outside pressure was the establishment of what has proved to be a successful spray ring. Incidentally, much valuable data have been collected, which should be helpful to hundreds of similar communities in need of such service. The Shawnee Mission spray ring is beginning its sixth season, the orchards are saved, and each year the waiting list of customers increases.

The growers in this community have found that a co-operative spray ring can be operated at a much lower per tree charge than was ever considered possible. When A. L. Berry, who directed vocational agriculture in the school, began looking for facts and figures on which to base charges the first year he could find nothing of the sort in print, with the exception of some very discouraging estimates from Ohio, which indicated that the cost would be from 10 to 40 cents a tree for each spray, depending on the size. For five years, however, the Kansas ring has charged from five to 15 cents a tree per spray, which has covered all operating costs and allowed the necessary depreciation reserve for replacing equipment. Mr. Berry has found that it costs approximately $30 a day to operate a large spray rig, $10 for labor, $10 for spray material, gas and oil, and $10 for depreciation of equipment. A three-cylinder pump is used, together with a four-horsepower engine and a 200-gallon spray tank. The outfit is mounted on a motor truck.

The most enthusiastic customers of the ring are those men who previously tried to do their own spraying with the inadequate equipment which is commonly used by growers with small tracts.

Number of Customers Increases

Shawnee Mission is a community within a few miles of Kansas City, with perhaps one-third of the acreage in small tracts of from one to 10 acres. The first year, 144 customers were served, and each year the list has grown. During the season of 1928, which was a small crop year due to the late freeze and consequently a smaller spray year, records show that 15,658 trees were sprayed. There are some large orchards in the community and some large trees which should compare in size with those sprayed by the Ohio spray ring. These large trees were sprayed by the Kansas ring at 12 cents a tree for each of five sprays.

A responsible paid foreman superintends the work of students in agriculture who go with him as a crew

While the spray ring at Shawnee Mission was organized through the rural high school department of agriculture, it was so largely a community affair that the first step in organizing was to form a committee of local fruit growers who were interested to act as directors, assist in determining rates the first year, purchasing material, auditing books, and advise in buying equipment.

The actual work is handled by a responsible, paid foreman, who superintends the work of two students in agriculture who go with him as a crew. After a boy is trained he is allowed 25 cents an hour for work in excess of his school requirement. In a class of 16 each boy would be on the rig one day in eight during the season.

The spray ring started work with a small rig and 40 jobs on the list. Before the dormant spray season was over, it was necessary to purchase a larger rig. The lack of tank capacity is the big objection to small rigs.

Factors Affecting Cost of Operation

Some factors which affect the cost of co-operative spraying are interesting. One thing which partly accounts for the economical operation of the rig is that the equipment is mounted on a ton truck, while other rings have depended on transportation by teams, which is costly.

The ability of the foreman to keep the equipment in operating order is important. When the charge is made on the tree basis, which seems the practical way, no revenue comes in while a hose is being mended, the valves cleaned in the engine, or while the rig is being dug out of a soft spot in the orchard.

Long hose is a good investment. Two pieces of hose, when coupled, should reach at least 250 feet, as this saves driving over lawns and gardens, being mired and losing time. Proper routing of the rig in the community to prevent long trips adds greatly to the amount of work accomplished. Naturally, big jobs are done most economically. The figures on two days' work show this fact. Six large jobs were done on one day, totaling $51.12, while a day of 10 small jobs brought only the sum of $38.70.

Another thing which has saved money in this community is the successful use of commercial oil as a dormant spray, eliminating the use of expensive spray materials later in the season for the control of aphis. When the Shawnee ring was formed, the use of oil was not encouraged by experiment stations, but it is beginning to be acknowledged that most of the difficulties experienced with this spray are due to the use of home-made mixtures, which cannot be properly made under ordinary conditions. Commercial (*To Page* 29)

New Sulphur Dust Combinations

Dry Lime-Sulphur in Combination with Ground Roll Sulphur of 300-Mesh and Finer Found to Give Excellent Scab Control Without Injury to Fruit or Foliage.

By H. C. YOUNG

Ohio Experiment Station

THE APPLICATION of fungicides and insecticides in the form of dusts for the control of fruit diseases and insects began about 25 years ago. Bordeaux mixture at that time was the leading spray material and was very effective in controlling apple diseases. It was generally thought that the disease problem was solved, but after several years Bordeaux began to russet fruit and burn foliage. Why this came about all at once is difficult to explain. Possibly the growers at that time overlooked the injuries, or it may be that the trees became less tolerant to copper, or changing climatic conditions may have contributed to it. At any rate, the injury seemed to be increasing at such a rate that the damage due to the spray was often greater than could have been expected from disease.

Then, lime-sulphur appeared upon the scene. It was found to control apple scab, the most common disease of the apple, and, consequently, it rapidly replaced Bordeaux mixture. Since 1909 it has been the standard fungicide for northern grown apples. About 1920 complaints began to come in. Lime-sulphur was causing trouble. It was following the same history as Bordeaux. This injury at first was reported only from a few places here and there, but it soon seemed to be increasing, until at present lime-sulphur would go into the discard if there were anything to take its place. It is accused of reducing the set of fruit, of burning and stunting the leaves, and of russeting and affecting the finish of the fruit. Many times it, too, has caused more injury than could have been expected from disease. Many substitutes have been placed on the market, but in the main none has been generally acceptable, and today lime-sulphur and its related compound, dry lime-sulphur, remain the standard spray materials. Many attempts have been made to devise a mild spray to replace it, but none has been found effective in severe scab epidemics.

Substitute Needed for Bordeaux and Lime-Sulphur

With these conditions confronting us, the need for a substitute for Bordeaux and lime-sulphur is paramount. Almost a continuous effort has been made since 1905 to develop a substitute in dust form. Naturally, the first dusts to be tried contained copper, because it was to replace Bordeaux. The results of a great many tests over a period of many years showed only spasmodic promise. During some seasons copper dusts controlled disease, while in other years they did not. They also produced injury at times. In fact, their only merit was in their application. On the whole, they are poor substitutes for Bordeaux, and have gained a very limited usage, except in a few sections where copper is required for the control of some specific disease other than apple scab.

About 1910 sulphur dusts were first tried. Early experiments gave promise. Since that time nearly every experimental station in the commercial fruit growing states has experimented extensively with sulphur dusts, and today there are no, or very few, unqualified recommendations for its exclusive use. In fact, even with all this experimentation and publicity, sulphur dusts have not replaced spraying in a very large measure. One might logically say that any substance or method having as many failures attached to it as dusting would be relegated to the discard, but not so with sulphur dust. Let us enumerate why the method is being kept alive and why so much experimental work is being done on it.

1. There must be a substitute for spraying, and especially for liquid lime-sulphur, because of injury.
2. Dusting saves time and labor.
3. Dusting can be done more quickly and its application can be timed more accurately, an important point in scab or any other disease control.
4. The finish of dusted fruit is almost always superior to sprayed fruit, an important point in this day of competition.

Improvement in Sulphur Dust Mixtures

Vast improvements have been made in sulphur dust mixtures during the past two or three years. Early dusts contained what is called a fluffer or spreader, and the cheapest material for this purpose is hydrated lime, a material which, we now know, reduces the effectiveness of sulphur. It is not now used to any great extent. A few years ago the finest sulphur obtainable for dusting was a ground roll 200 mesh. After several

laboratory and field tests it was found that the only sulphur sticking to leaves through rains is even finer than 300 mesh, and at present most of the sulphur dusts sold for dusting purposes have a guarantee of this fineness.

With these improvements, dusting has gained ground, but it is not good enough yet. It fails too often in severe scab epidemics. However, it has a definite place in pest control, and, as more improvements are made, will eventually replace much of the summer spraying. Even at present the following recommendations are safe:

1. When diseases, especially scab, are not too serious, dusting should replace summer spraying. There are many fruit-growing sections having good air drainage and conditions, in general, unfavorable for scab.

2. Where scab has been held in check during the pre-blossom period, dusts may be used in subsequent applications.

3. Dusts may be used on varieties that are somewhat resistant to scab, such as Grimes, Jonathan, Baldwin, etc.

4. Dusts may be used during seasons when conditions are somewhat unfavorable to scab development.

5. Dusts without poison may be used for blossom applications. Frequently, scab spores are discharged during bloom, and an application of dust will control it.

6. Dusting may be used to supplement the spray rig. The first criticism given on such recommendations is that the grower cannot foresee these conditions. But he can, especially with the help now available. The real objection, however, is that two sets of equipment and two kinds of materials are needed, a condition which a small grower cannot often afford to meet. Dusting rigs have become a part of the equipment of many of the larger growers. The failure of dusts certainly has not been due to the dusting rig. There are two general types of dusting machines on the market. The one applies ready-mixed dusts, the other contains a self-mixing appliance so that the various ingredients may be placed in the hopper and mixed as used. Both types are very efficient.

It certainly can be safely said that dusting has become a part of orchard pest control. It must also be said that it has many serious limitations. Three years ago it was our aim to eliminate as many of these as we could and to attempt the development of a dust mixture that would replace spring and summer spraying. Many of our mixtures have been tried in the field and have given excellent promise. Some have injured, as it is well known there is a small margin between safety and effectiveness. (*To Page* 31)

1928 Results on Dusting for Apple Scab

Bingham Orchard, Chardon, Ohio

Material	Total Fruit Count	Moderate Scab	Severe Scab	Per Cent Scab Moderate and Severe
85-15-S-DLS	708	16	15	4.4
90-10-S-DLS	619	72	19	14.6
300 mesh pure sulphur	1,262	196	106	23.9
Commercial dust.....	655	116	29	22.1
85-15-5-S-DLS-B	Counts made July 10			10.3
85-15-5-S-DLS-lime ..	Counts made July 10			13.0
85-15-S-DLS	Counts made July 10			2.3

Moderate scab reduces grade from No. 1 to No. 2. Severe scab places apples in culls.

Spray SERVICE and the Spray CALENDAR

Arguments of Those Who Abolish the Spray Calendar in Favor of "Spray Service" Are Based on Assumptions Which, in the Opinion of the Writer, Are Without Foundation.

By F. D. FROMME

Virginia Experiment Station

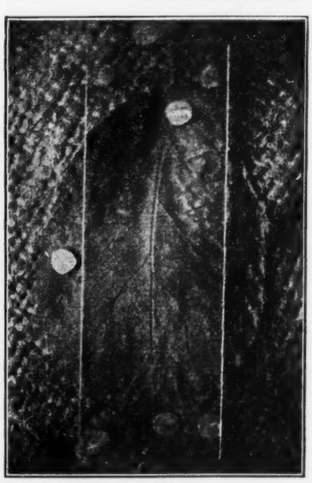
THE ARTICLE entitled "A New Standard for Spray Schedules," which appeared in the February, 1928, issue of the AMERICAN FRUIT GROWER MAGAZINE, was well calculated to cause the fruit grower who has depended on a spray calendar for the timing and proportioning of his apple sprays to do some thinking. The article depicted the ultra-modern in spray service. Detectives armed with microscopes and spore-traps watch the movements of the enemy (apple scab), super-forecasters foretell the weather with accuracy, and modern Paul Reveres ride the phone and radio with last-minute warnings to the fruit grower, "Spray now for apple scab. You have 36 hours in which to protect your orchard." The reader is informed that "at least one state experiment station no longer publishes a schedule of the old kind for apples, feeling that it is destined to become as obsolete as the barrel spray outfit." The article was well written and the presentation of ideas was sufficiently dramatic and plausible to enlist the interest of the fruit grower and cause him to yearn for spray service of the new type. If he lives in one of the 46 states that adheres to the old-fashioned calendar, he may conclude that his agricultural college is behind the times in such matters. He will likely ascribe such failures, as he has had in previous years, to the lack of an adequate, up-to-date spray service.

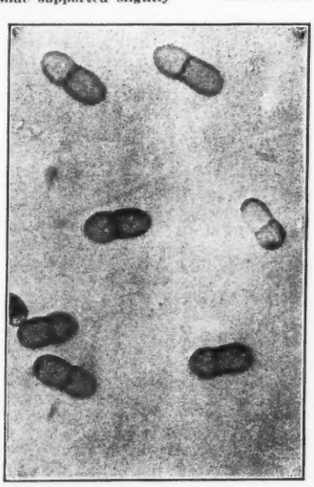
Shall We Abolish the Calendar?

Without question the points raised are worthy of serious consideration. If it is true that the spray calendar has outlived its usefulness and that we can grow better apples without it, then by all means let's burn it and give the new idea a whirl. Before we apply the match, however, it may not be a bad idea to compare the vehicle that has served us so long with the substitute that is supposed to be better.

No one would assert that the spray calendar of the past was without faults and errors. It was developed chiefly by the trial and error method and by observing the periods when the pests and diseases did the most harm. It has undergone a steady, progressive evolution as new facts were developed by the research pathologist and entomologist. This evolution has been especially rapid in the past few years, due to an increased volume of research into the private lives of the pests and diseases. The aim always has been increased efficiency, and it has been reflected by a steadily increased quality of product. The calendar is not perfect, since perfection is difficult of attainment, but it is noteworthy that the grower who adheres to the letter of the up-to-date calendar and who puts on plenty of material will have little to show in the way of a cull pile at harvest.

Above—The Laboratory at Winchester, Va., where continuous studies of apple scab have been conducted for the past six years by F. J. Schneiderhan. Below, left—Method used in trapping scab spores. The over-wintered leaves are placed on burlap and tacked to the ground. A glass slide supported slightly above the leaf by tacks catches the spores as they are shot from the leaves during rainfall. Right — Ascospores of the apple scab fungus as they appear under the microscope after having been shot from the over-wintered leaves. One cell of the spore is typically shorter and broader than the other





The criticism of the calendar is directed chiefly at the fixed nature of the spray periods which are based on development stages of the trees. It is argued, for example, that the condition of the fruit buds is not a reliable criterion of the condition of the spores of apple scab which may be on schedule as announced by the buds, but are just as apt to be ahead of it or behind time. Sprays applied too long in advance of the ripening and ejection of the spores are supposed to be wasted, and similar waste and failure to control will result from sprays applied too late. Greatest efficiency results when the spray is applied just in advance of the period of spore ejection. It is the function of the spray service man to determine when such periods are about to occur and to tell the grower, "Now is the time." He does this with the aid of the microscope, the spore-trap and the meteorologist. Presumably he does not own an old-fashioned calendar and has purged his mind of all of its teachings.

The arguments of those who would abolish the spray calendar are based on certain assumptions which, in the experience of the writer, are without adequate foundation. Since the argument appears to center on the control of apple scab, we will adhere chiefly to this phase of the question.

Apple Scab and the Spray Schedule

The studies of the ejection of the spores of apple scab made at Winchester, Va., by F. J. Schneiderhan, of the Virginia Experiment Station, are probably the most complete that have been recorded. Beginning in 1922 and extending through 1927, they provide six consecutive annual records. Continuous records of precipitation, temperature and relative humidity have aided the interpretation of the spore records, and studies of the efficiency of sprays applied on a fixed schedule have added the third link to the chain of data, which are naturally too extensive to permit more than a very brief review in an article of this nature. Mr. Schneiderhan's findings may be summarized as follows:

At Winchester, under varying extremes of weather, one may expect ejections of scab ascospores at any time during the months of April, May, June and July. The essentials are a supply of matured ascospores in the overwintered leaves, and rainfall. Under average conditions, however, the spores are not liberated earlier than the middle of April nor later than the middle of June, a period of 60 days. In general, there are as many as 12 distinct ejections during a season; the minimum number has been nine and the maximum 16. In the average season, therefore, we must anticipate 12 discharges of ascospores during the 60-day period of rapid development of foliage and fruit; a discharge every five days provided the rainfall were evenly distributed in this fashion. What does the field agent of the spray service do under such conditions? Does he cry "Wolf" to the growers 12 times a season? Presumably not, if he wishes to keep his health and strength. He considers the earlier discharges, those that occur during the pre-blossom period, as especially important. He argues that uncontrolled initial infection makes future control difficult or (*To Page* 33)

SUMMER OILS in ORCHARD PRACTICE

The Results of Some Trials of "Summer Oils" in Apple Orchards in the Central States, for the Control of Codling Moth. Pointing the Way to a Possible Solution of the "Residue" Problem.

By C. R. CLEVELAND
Entomologist, Standard Oil Company

AN AWAKENED APPRECIATION of the effectiveness and value of oil sprays in general, together with a growing realization that the many different kinds of oils of varying degrees of refinement and other physical and chemical properties might easily have a distinct bearing on their effect on trees in leaf, have suggested the possibility that oils might be successfully and safely utilized for the control of certain species of insects infesting fruit trees under summer conditions.

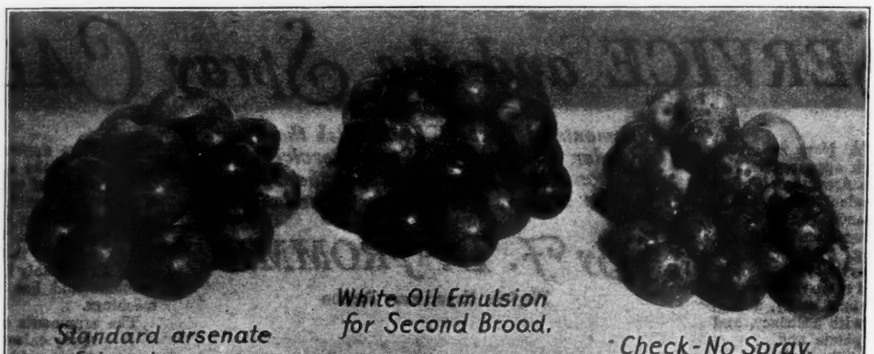
Extended study and experimentation along these lines has indeed already shown that certain insects not heretofore considered susceptible subjects for control by oil do yield satisfactorily to its effect. They have also demonstrated that certain special types of oils may be used with a much greater degree of safety on trees and plants in leaf than can certain other types of oils or oil preparations. Thus there has emerged into the oil insecticide field what may be termed the summer or white oil sprays.

Extensive investigation has proved that the so-called white oils are less injurious to foliage, fruit or other plant parts than the less refined oils of the lubricating types. A white oil is one in which the process of refinement has been carried to a point where a large percentage of its original unsaturated hydrocarbon content has been removed, and this ordinarily results also in the removal of most of its color—hence the general designation, "white oil." It appears that it is the unsaturated hydrocarbon elements in petroleum oils which are most instrumental in causing plant injury. Thus, the elimination of these injurious elements results in a material decidedly less injurious than one in which they are still present to a degree sufficient to cause damage.

The kind of emulsifier used to prepare the finished spray product is of importance also. Thus, a given white oil emulsified with a chemically active emulsifier, such as a soap, for example, may be nearly or quite as injurious as a less refined oil emulsified with a special non-soap emulsifier. A white oil prepared with such a special emulsifier produces the safest spray, all other things being equal.

Viscosity (body), volatility, breaking quality and other factors also unquestionably have a bearing on the relative safety of a given summer oil spray.

A knowledge of the above principles has progressed to a point where it has become possible to prepare summer or white oil sprays which can be used in effective concentrations on certain trees and plants with a degree of safety from possible injury favorably comparable with other established insecticides.



The apples in the middle pile, being farther from the camera, appear smaller than those in the pile at left, whereas they are practically the same size. There was no discernible difference between the apples at the left and those in the center as to color, finish or freedom from blemishes of any kind

Oil Sprays for Codling Moth

We are still a long way from knowing positively all of the uses to which these new types of oil sprays may profitably be applied, of course. But there is one important use which has received special attention and a sufficient amount of investigation to warrant a discussion of the relationship summer oils bear to it and pretty definite conclusions as to their present status. I refer to summer oils for the codling moth.

Two factors are especially responsible for the recent lively interest in summer oils as a possible means of control of this insect. They are (1) the arsenical residue problem; and (2) unsatisfactory control by long-established standard sprays.

The second factor has been responsible, undoubtedly, in some degree at least, for the development of the first. There have been evident indications that the established program on arsenical sprays has not succeeded in controlling the codling moth as satisfactorily as in former years. In certain cases it has been demonstrated that reported failures have been at least partially due to other factors, such as failure to spray thoroughly, poor orchard and packing shed sanitation, unusually favorable conditions for codling moth development, and the like. However, the fact remains that for one reason or another there has been noted a tendency in some sections toward the necessity of using an increased number of sprays or increased concentrations in order to secure adequate protection. Even where this has been done, the results have not always proved entirely satisfactory, especially as regards the sting type of worm injury.

Meeting the Spray Residue Situation

These conditions have conspired to focus attention on arsenical residues carried by harvested fruit, resulting in certain prescribed regulations having been promulgated by governmental agencies as to the allowed amount of residue.

In order to meet this new situation, in case a modification of codling moth control practices might become necessary, active attention has been directed toward the discovery of possible effective non-arsenical sprays. One of the first of such materials suggested has been oil. From the safety standpoint, white oil emulsions of a certain type offered the best possibility, and, as stated above, have now been developed to a point where the safety requirement appears to be well satisfied, so far as experience thus far will disclose. The next fact to be determined was the effectiveness of such oils in controlling codling moth and the best way of using them.

Two rather distinct lines of approach to this problem, suggested by conceptions of the possible ways in which an application of oil might react on the codling moth, and also by a consideration of the best ways of reducing residues, have been adopted in investigations in different apple growing sections of this country.

The first thought presented was that oil might serve either in immediately killing the eggs or young hatched worms not yet inside the fruit, or as a possible repellent in preventing the moths from depositing eggs. In any event, about the only hope entertained at first was that oil might serve as an aid to arsenate of lead, and with this in view a considerable amount of early investigation was devoted to a use of the oil in (*To Page* 10)

TILLAGE an AID to CONTROL WORK

Early Working of the Orchard Soil Will Turn Under the Diseased Foliage, Will Destroy Many Insects, Eggs and Pupae, and Lighten the Subsequent Work of Spraying and Dusting.

By T. J. TALBERT
University of Missouri

THE FOOD BILL paid annually to injurious diseases and insects may be greatly reduced by plowing up the orchards, vineyards and other fruit plantations. Why wait until next spring or summer when greater quantities of high priced fungicides and insecticides will be required as sprays? Moreover, during the winter or early spring when many orchard pests sleep the grower can take advantage of their inactivity by plowing many of them under and rendering them harmless.

When weather and soil conditions will permit, the fruit grower may lessen the injury from orchard pests by plowing or disking the orchard soil during the winter or early spring months. The stirring and burying of the top soil will destroy many of the fruit grower's most injurious insects. This applies particularly to the curculio, codling moth, cutworms and other injurious insects. The cultivation destroys the winter hibernating quarters of many injurious insects and exposes them to the alternate freezing and thawing of winter conditions, which usually proves fatal. Those that are not destroyed by the weather, animals or birds, may be covered so deeply that they will be unable to reach the surface soil in spring. Still others will be killed by contact with the plow or disk.

Some of the most important diseases controlled by tillage are apple scab and cherry leaf spot. The apple scab disease and the cherry leaf spot go over winter almost entirely on the old leaves. Thorough plowing or disking that will cover up these leaves will lessen the attack by these fungous diseases the following spring. No cultural practice could be more timely or more valuable to supplement thorough, timely, and careful spraying than tillage during the winter season or early in the spring.

Plum and apple curculio beetles spend the winter in rubbish or similar shelter in or near the orchard. The most experienced investigators and successful fruit growers agree that the best control consists of killing the over-wintering beetles by cultivation during the dormant period or early spring and early spraying. If the rubbish is eliminated so far as possible by plowing under deeply and the surface soil is thoroughly disked and pulverized, the grower may be certain that curculio injury will be greatly diminished the following year. This is true because the hiding places of the beetles are destroyed and the beetles themselves are killed. Where clean cultivation can follow winter plowing, it acts as a splendid supplement to careful spraying. The young which emerge from the fruit in late spring and early summer enter the soil to transform. Cultivation destroys the larvae or grubs and assists materially in preventing rapid multiplication.

Recent investigations of the codling moth show that this serious fruit pest prefers to winter under artificial or man-made covers. Pieces of boards, branches of the trees, old gunny sacks, piles of leaves, barrel heads, old picking crates, and the like, left around under the trees and scattered about over the orchard have been found to be the best types of over-wintering quarters for this pest. The cleaning up and burning of this rubbish and the plowing of the ground is sure to make the fight with sprays against this pest twice as easy and less expensive the following spring and summer.

Winter or Early Spring Tillage

Few growers realize the great benefits which may be derived from winter or early spring tillage. Too often a crop of clover or some other crop which lives through the winter may be so satisfactory that the grower hesitates to plow it under. He may believe that it should be left just as long as possible in order to add humus to the soil when it is plowed under.

The chief objection to plowing late, say the latter part of May or early June, is that the fibrous roots of the fruit trees are destroyed. The destruction of these roots may be a matter of considerable consequence, as these are the main feeding roots. These root hairs do not live over winter but are grown each spring after growth starts. Plowing during the dormant season or early in the spring does no harm to root hairs, as is sometimes believed.

While more humus may be added to the soil by late plowing, yet the ability of the tree to take up moisture may be greatly lessened as a result of cutting off the hair roots. Moreover, if plowing is done late instead of early in the season, the transference of water from the subsoil into the furrow slice may be interfered with. This is true because considerable time must elapse before new feeding roots can be established in the surface layer.

One of the greatest benefits derived from spring tillage is the increase of nitrate nitrogen. The supply multiplies much more rapidly in spring-plowed soils. This is due mainly to better aeration and the killing of weeds or the cover crop. To benefit most, therefore, from this nitrogen supply, it is important that the plowing be done in the autumn, winter or early spring. Thus the supply of nitrate nitrogen is heavily augmented in the spring and early summer when the trees are in greatest need of it.

Spring and Summer Tillage

The principal objects or purposes of cultivation during spring and summer are to conserve moisture and kill weeds. In general, cultivation should be made every 10 days or two weeks, or at least as soon after every rain as the soil will do to work. After the winter or early spring plowing or deep disking, very shallow stirring of the soil is all that is necessary. The sooner the grower is able to get over the land after rains, the better, as a rule.

Such tillage will destroy many insects and diseases by destroying holdover and harboring places. It will also supplement spraying and dusting practiced for the control of fungous diseases by covering and destroying diseased foliage, fruits and twigs.

Tillage Is Manure

Perhaps there is no more important factor in fruit production than thorough and frequent stirring of the soil to make plant food available and to assist in the conservation of moisture. Thorough cultivation is essensential. The old saying, "Tillage is manure," holds true for fruits, vegetables and truck crops. This applies to both the new and old plantings. For best results, as many as five or six plowings and one or more hoeings may be required, although few plantings receive this much care. In other words, the trees or plants should be cultivated at intervals of 10 days or two weeks from the time they are set until July. The number of plowings and hoeings will depend a great deal upon the amount of rainfall. It is very important that the ground be stirred as soon after each rain as it will do to work. If the interval between rains is four or five weeks, more than one shallow (*To Page* 30)

OPERATING the AIR-COOLED STORAGE

The Most Efficient Air-Cooled Storage Requires Intelligent Management for Best Results. The Maintenance of Correct Temperature and Humidity Requires Constant Watchfulness and Care.

By CLARENCE E. BAKER

Purdue Experiment Station

WHEN ONE speaks of the operation of an air-cooled apple storage, he is often looked upon in amazement, as there seems to be a prevalent idea among uninformed fruit growers that such a storage needs no personal attention. It is sometimes considered to be an automatic contrivance that cares for itself and can be depended upon to do the right thing at the proper time.

Unfortunately, this is far from being the case. Without intelligent management, the most efficiently constructed air-cooled storage will not give satisfactory results. On the other hand, through careful and efficient operation, minor defects in construction often can be overcome and a rather poorly constructed storage may be made to function in a satisfactory manner. The operation of an air-cooled storage during the early fall months consists principally in opening and closing the ventilating system at the right time to take advantage of temperature changes. The idea in mind should be to admit all the air possible that is cooler than the fruit, and to exclude air from the building when it is warmer than the fruit. This is accomplished by opening the intakes and outlets at all times that the outside temperature is lower than that in the storage room, and closing the ventilating system as soon as the outside temperature begins to rise to near the temperature within the storage. Conditions satisfactory for ventilating the building occur chiefly at night during early fall, but an occasional day may be found when it is cool enough to leave the storage open.

Temperature Must Be Watched

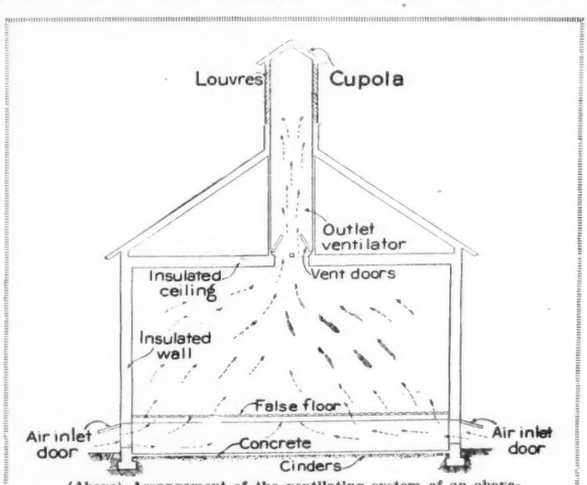
Someone should be assigned to care for the storage, and this person should observe the temperature in the storage and without in order to know when to ventilate the building. No set practice can be made of opening the ventilators each evening and closing them in the morning, as frequent nights occur when the temperature of the fruit would actually be raised if the ventilators were opened. If the ventilating system is in operation when the outside temperature is higher than the storage temperature, the movement of air will be reversed and warm air will be brought into the building.

It is well to expend considerable thought in the operation of the ventilating system to obtain the best use of the cold air that is admitted. For instance, in certain types of buildings, if the air intakes on both sides of the building are opened at the same time, a strong breeze may simply force the air in through the air intakes on one side of the building, across beneath the false floor and out the other side without the air passing up about the stored fruit. Under such conditions it would be better to open the ventilators on the windward side of the storage only.

Fruit Cools Slowly

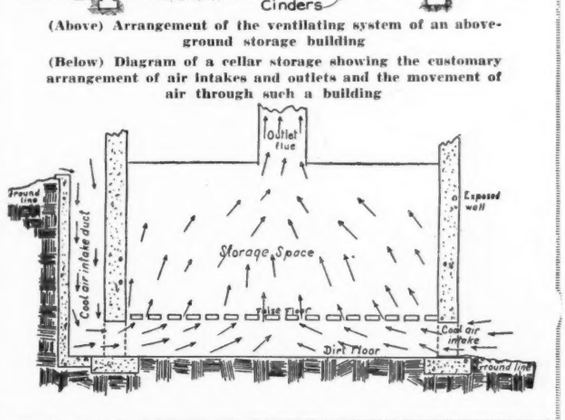
In early fall, with a large amount of fruit in the storage, cooling takes place slowly, as it seldom is possible to cool the storage to the temperature of the outside air. The storage temperature, during the early fall months, follows the average outside temperature as well as the outside minimum; consequently, it is only possible to hold the storage at a temperature of some three to five degrees below the average daily temperature outside or about five degrees above the daily outdoor minimum. This illustrates the impossibility of holding a 45-degree temperature with only an occasional drop to 40 degrees at night, with daytime temperatures of 80 to 90 degrees. The storage is closed as soon as the outside temperature begins to rise, to hold as much of the low temperature secured as possible. When the ventilators are closed, the temperature will rise a few degrees as long as heat is being given off by the fruit.

If the air in the storage room becomes too dry, moisture will be taken from the apples, causing them to wilt or shrivel. If the air is too moist, rots and moulds are likely to grow at an abnormal rate. The latter condition, however, is not frequently found in air-cooled storages. Storages with dirt floors that remain moist seldom suffer from low humidity. Storages with concrete floors or dirt floors that become dry frequently require an artificial supply of moisture to prevent the wilting of the fruit. In such storages the walls and floor should be thoroughly soaked at frequent intervals. One Ohio fruit grower, whose storage has a concrete floor, makes a practice of giving the apples a good soaking with a hose every few days, beginning at the time the apples are stored and continuing throughout the season. By this method he has succeeded in solving his humidity problem and can hold his fruit in a crisp, juicy condition until late spring without experiencing any undue losses from rots.



(Above) Arrangement of the ventilating system of an above-ground storage building

(Below) Diagram of a cellar storage showing the customary arrangement of air intakes and outlets and the movement of air through such a building



Store Fruit When Cool

A consideration of the above statements will indicate the value of having the fruit as cool as possible before placing it in storage. It is poor practice to bring in hot fruit from the orchard and put it directly into the storage. A much better method is to leave the warm fruit out in the orchard over night and bring it into the storage early the next morning while it is still cool. By this procedure, the fruit is cooled more than it would be in several nights in the storage, and the storage temperature is not raised by the entry of warm fruit. Furthermore, the doors need not be opened during the hotter part of the day, which in itself is a bad practice.

Winter Management

During freezing weather the operation of an air-cooled storage consists of maintaining a temperature near the freezing point without permitting the fruit to freeze. A temperature of 32 to 36 degrees is satisfactory for the farm storage. As apples do not freeze until a temperature of 29 degrees or below is reached, occasional drops in temperature below 32 degrees need not cause alarm unless the temperature has reached the danger point in some part of the storage. If it is impossible to prevent freezing by tightly closing the building, it may be necessary to employ lanterns or an oil stove to raise the temperature above the danger point. Such a condition, however, indicates some fault in construction which should be located and corrected.

Generally, it is necessary to keep the storage tightly closed during the severe winter weather, but any occasional warm day should be taken advantage of to open up the building and give it a thorough airing, as the air in an unventilated storage becomes foul and stagnant from the gases given off by the fruit.

Handling Apples for Storage

Apples intended for storage should be well matured but not over-ripe. Immature fruit is susceptible to storage scald and is the first to wilt in storage. Over-ripe apples frequently become mealy, develop internal breakdown and crack open in storage, thus greatly lessening their storage life.

Recent investigations conducted by the United States Department of Agriculture indicate that apples for common storage should be left upon the tree as long as they are holding well and as long as there is no danger from freezing. This recommendation is based upon the fact that apples soften more rapidly at temperatures prevailing in common storage during the harvest season than they do upon the tree.

Handle the fruit carefully to prevent bruising and skin punctures and keep the fruit in the shade after picking. It is useless to fill a storage with bruised or injured apples, as decay organisms will soon invade the injured tissues and rots will quickly destroy the fruit.

Ventilated bushel crates are usually (*To Page* 29)

Have You Ever Sprayed at Night?

More Often Than Not High Winds Will Be Encountered During Daylight Hours That Prevent the Utmost Effect from Sprays or Dusts. Some Extensive Trials of Night Control Work.

By H. A. CARDINELL

Michigan State College

ALBEIT a strange question for agriculture, some have remarked, "If it comes to that, I'll quit." A fruit grower replied, "What! Sell my bed and buy a lantern?" He is now doing all of his dusting at night, and likes it. But let us see if there is reason for considering lengthening the day.

Almost every season witnesses an outbreak of some disease or insect of one or more fruits in some important section of the country. Invariably, orchardists whose crops were injured beyond their liking, cast about for another spray material that someone has intimated might give better results.

Why do so many growers fail to get protection against an outbreak of scab, psylla or some other pest? They have used their equipment for many seasons. Often they have used the same recommended control measures against the pest for many years, yet an outbreak of any pest results in failure for about half of the growers of that territory.

Most Growers Fair Weather Operators

To face the situation honestly, it must be admitted that a large proportion of the fruit growers of North America are fair weather producers—their best results are obtained in seasons that are most favorable for the crop and most unfavorable for pests. Such years are usually "big crop seasons" with low unit prices.

Fruit farmers who are financially prosperous are those whose site and varieties yield something marketable and who are good managers of the important things of the growing season, including the insurance of good spray protection. When certain situations cross the path of a light crop year, such as the many fruit commodities experienced in 1921 and 1927, excellent net returns result to many growers. Oft times, light crop commodity seasons are further lightened by the outbreak of some pest; thus the best operators do the best spraying and obtain the greatest protection. In other words, the largest profits go to those who are best able to help themselves. Spray protection in particular is largely a matter of the fruit grower helping himself. Any spray service, spray calendar or advice in any form helps most those who are able to help themselves, by putting service into practice. It is a sad scientific fact that half the growers of America fail to rescue more than half of the season's output in quality of product, free from controllable blemishes; yet fortunate it is, lest the fruit industry might be faced with a serious problem of overproduction.

Epidemics and the State Spray Schedule

If these, my observations of a large representative group of mid-western fruit growers, are correct, why do not more of our better class of commercial orchardists obtain prevention through their spraying, rather than a partial cure, which always weighs so heavily on the pride of the owner? In many cases, too small a part of the spraying cost is spent before the first of June or July and too much of the season's protection-cost is spent in the last half of the spraying season trying to remedy the situation. Therefore, prevention of pests, as every state schedule calls for, is not the rule in practice, and attempts to spray out a cure after July are very frequently disappointing and usually result in high spray cost with low results in pest control.

Those in charge of pest control in many orchards, especially in orchards that have faulty spraying in epidemic seasons, do not give adequate protection until after blossom petals have fallen and the "June drop" gives an indication of the "crop set." After this stage, more or less spraying is decided for the season. In many cases, a closer application schedule, often meaning not more than one more application, sandwiched into an average or a dry season schedule, would afford an ample preventive measure for a wet season, when diseases are certain to be more troublesome.

Another Coat Versus a Priming Coat

In the terms of the paint industry, is the growers' problem a matter of renewing a coat of spray on the leaves and fruits that have been sprayed before, or is it more important to give the first coat of spray protection to the new leaves that have come out at each growing point of twig and spur, since the last application was applied? Both measures are necessary and it is impossible to spray or dust new growth area without recoating leaf and fruit surface that has already had one or more "priming" coats. In a fruit plantation that is given thorough coverage at each application, the item of greatest importance is the frequency of application, or in other terms—timeliness of each protective coat to unsprayed surface. Two able investigators of New York, Thatcher and Streeter, have published the results of their findings in Geneva Tech. Bul. 116, and summarize their 1925 findings with liquid sulphur and sulphur dust as it was perfected at that time. They state, "that from 89 to 94 per cent of the sulphur applied as dust was lost from the foliage during the first week; while the losses of sulphur derived from lime-sulphur spray without Kayso, varied from 45 to 75 per cent."

It would appear from the above paragraph that during wet spring weather, the shortness of the period of weathering of many dust and liquid applications on fruit and foliage, is not over a week and if germination of disease reaches a peak during a long rain, there is little strength of material left, many times, to protect the plant. Thus it seems logical that during rapid spring growth when weathering of materials is the shortest, yet the period of discharge of dangerous spores is longest, a shorter lapse of time between each two application periods would be advisable.

Failure to Control Means Failure to Protect

With but a few exceptions, where pests require that a contact take place between

(*To Page Thirty*)

A Michigan night dusting scene. In every week there are usually more calm hours during night than during daylight. Night hours are used to give leeward protection so difficult to accomplish, timely, in daylight. The owner of this equipment, O. H. Roth of Allegan county, uses separate gas tank units for tractor and duster. Note the modern trend: automobile tires and springs, and coil springs on the dust operator's platform. Comfort is fast being built into orchard machinery. To spend half one's energy in order to stay with the machine is not inducive to thorough work

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UCC

Summer Oils in Orchard Practice

(*From Page Six*)

combination with arsenicals, largely in the first brood or early summer sprays. Such experiments showed that the addition of oil in this way did increase the protection afforded the fruit from attack and injury.

Carefully observed experiments showed that the oil was successful in killing a considerable percentage of the eggs, and that it would also kill newly hatched larvae exposed to direct contact. Other experiments have indicated that there is little, if any, repellent influence of oil against egg depositions by the moths. This has led to a rather prevalent notion that oil must have no value against this insect except as a direct immediate contact spray for eggs and larvae.

It has also been observed that oil combined with arsenate of lead acts as an adhesive for the lead, and this undoubtedly in itself aids in control. So, while it was demonstrated that a superior control of first brood worms could be secured by the above method, it was not plain that this control might be sufficiently complete to justify the wisdom of omitting second or third brood sprays.

Thus, the above method offered no particular solution of the problem of reducing residues late in the season, and, in fact, tended, if anything, to aggravate the residue difficulty.

The next distinct possibility presented was that the film of oil left on leaves, twigs and fruit might in some way afford protection from worm entrance into the fruit by larvae hatching after application of the spray. It was considered possible that this oil film might kill the tiny young worms as they crawled over or through it or might serve as a physical means of interfering with normal worm activities so as to prevent successful entrance.

Accordingly, experiments in which oil was applied to apples, after which newly hatched worms were placed on such fruit at varying intervals, were performed. These tests showed that such treatment did actually operate in killing or otherwise affecting the larvae, so that considerable protection, in some cases of high degree, was afforded the treated fruit.

Oil as a Substitute for Arsenicals

These results led to a conception of the possibility of utilizing oil alone as a complete substitute for other insecticidal sprays in second brood or later season applications, thus contributing toward a solution of the residue problem as well.

Thus, for the past several seasons, a concentrated and extensive effort has been made by means of field experiments and practical orchard trials to determine how white oil emulsions of a certain type and grade used alone as a complete substitute for arsenicals will perform in controlling the codling moth and function generally as a practicable orchard spray.

Such experiments and trials of which we have knowledge were most extensive and significant in the summer of 1928. The results of these may be briefly summarized, as follows:

A total of 41 separate plot orchard tests or trials were conducted in 21 different commercial orchards in six middle western states, using a white or summer oil emulsion of the type described earlier in this article. In over half of these tests the oil was used alone without combining it with any other materials as a second brood or later season spray. In the remainder it was used in various other ways.

In obtaining the results of these trials, upwards of 50,000 apples were examined, and the number injured and uninjured by codling moth were recorded. In all cases counts of a representative amount of fruit from trees sprayed with a standard arsenical schedule throughout the season were made as comparative checks.

Taking figures only from tests where oil was used to replace arsenate of lead in second brood sprays, and making no differentiation between stung and wormy fruit, we have the following figures representing a grand total average of results:

Treatment	Per cent of injured fruit	Per cent of clean fruit
Standard arsenical for first brood—Summer Oil Emulsion for second brood	15.5	84.5
Standard arsenical throughout	22.2	77.8

Taking figures from those tests where a separate count was kept of stung and wormy fruit, we find the following grand average:

Treatment	Per cent of fruit stung	Per cent of fruit wormy	Per cent of total injury	Per cent of clean fruit
Standard arsenical for 1st brood — Summer Oil Emulsion for 2nd brood..	12.6	12.9	19.8	80.2
Standard arsenical throughout..	21.8	14.7	27.0	73.0

The accompanying illustration of three piles of apples is offered as a visual record of the results obtained in an orchard comprising one of the units of these experiments. The left hand pile shows a representative sample of apples from a block sprayed with a standard arsenical and fungicide schedule. The middle pile is a similar sample from a block sprayed with a standard arsenical and fungicide schedule up to the second brood, and then receiving two sprays of two per cent white oil emulsion alone for the balance of the season. The right hand pile is fruit from unsprayed trees.

It will be noted that the apples in the center pile appear relatively smaller than those in the pile at the left. That is due to their being farther from the camera. There was actually little difference in size, except for the unsprayed apples, which did run decidedly smaller.

The pictured samples also show practically no discernible difference between left and center piles as to color, finish, or blemishes of any kind.

Results of Experiments With Oil

The above figures indicate that where oil was used alone for second brood codling moth as a substitute for arsenicals, it resulted in the production of about seven per cent more fruit free of any kind of codling moth injury. The percentage of worm entrance injury or wormy fruit was only a trifle less on the oil plots, but sting injury was rather strikingly less.

There were four exceptions out of 21 to this general trend so far as total injury was concerned, but in the case of sting injury, the trend was in favor of the oil treatment.

In all these trials the oil emulsion was used at two per cent concentration (two gallons to 98 gallons of water).

In the tests where the oil was used in earlier sprays in combination with arsenate of lead, the results were favorable so far as codling moth control was concerned but no better than where the oil was used alone in second brood sprays preceded by standard arsenicals.

Where oil was used throughout the season as a complete substitute for arsenicals, the results were not fully equal to those obtained from a standard arsenical program throughout. Furthermore, one case was noted where a heavy schedule of oil spraying (five to eight applications), in both early and late season, resulted in injury in the form of dropping. These indications, together with the necessity of using a fungicide such as lime-sulphur in early sprays for scab control, with which oil cannot yet be used without danger of injury, all suggest strongly that the use of oil for second brood sprays only is at present the sounder practice. Where this practice was followed, no clear evidence of injury to fruit or foliage was noted where white oil emulsions of the best type were employed, although in one case, of an orchard located in an especially dry and hot section, some of the oil-sprayed fruit was more deeply colored on one side than fruit receiving no oil.

From the extensive and unusually consistent evidence thus produced by the tests above recorded from over 20 orchards in six states, operating under varying conditions of climate, severity of codling moth attack, and methods of use, it seems quite safe to say that a properly compounded white oil emulsion applied at two per cent strength in second brood sprays may be relied upon to give a control of codling moth at least equal and possibly somewhat superior to that which may be secured from the use of an arsenical throughout the season.

The possibility of using white oil emulsion as a substitute for arsenicals in the later summer sprays to avoid excessive residues where necessary, seems therefore well established.

Summer Oil for Pear Psylla

Another field of use for this type of oil sprays which now appears quite well established is that of pear psylla control, at least under middle western conditions. Rather extensive tests in the pear psylla area in Michigan during the past two years have consistently shown that a one and one-half or two per cent concentration of white oil emulsion applied as a single midsummer spray results in commercial control of this insect for the balance of the season.

It is of interest to note that the effect of the oil in this case appears to be a residual influence on the development of

(*To Page 31*)

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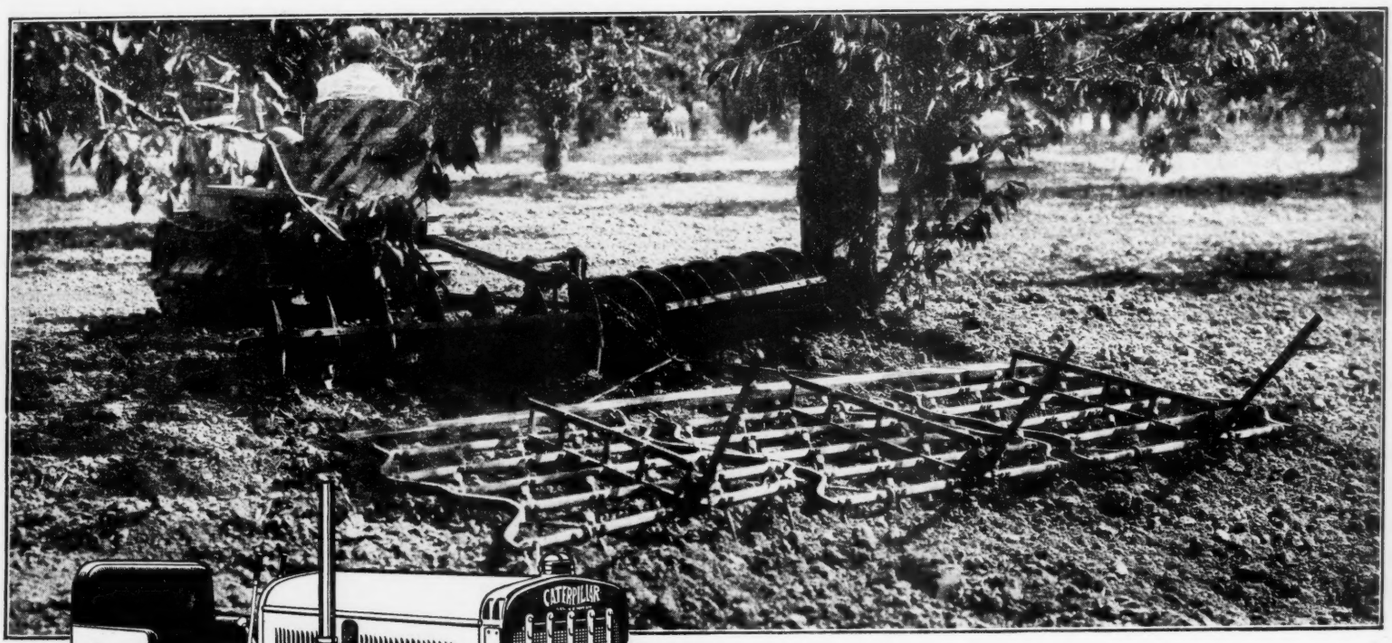

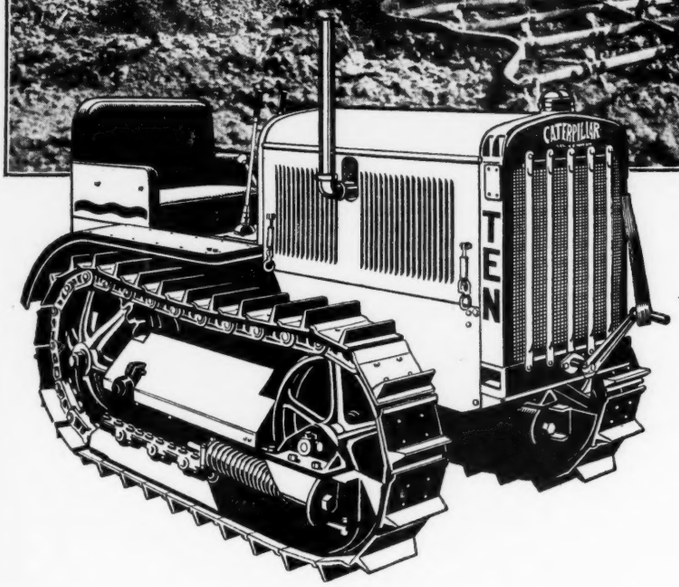

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The Market Review

By PAUL FROEHLICH

United States Bureau of Agricultural Economics

CONSIDERABLE IMPROVEMENT occurred in fruit and vegetable markets after January 1. Prices showed a slight upward trend for most products, and carlot movement increased rapidly after the holiday dullness. Total shipments during the first week of January were 53 per cent greater than those of late December.

Attention Given to Packing

It is always encouraging when a fruit-producing district can show concrete benefits from a law governing the grading of its products. A recent report of the Virginia Division of Markets shows practically unanimous approval by apple dealers of the state apple grading and marking law in its first year of administration. Efforts were made to ascertain whether the objects of the law—uniform grading according to definite standards, and uniform marking on the containers that truly represents the contents of the package—were being attained. About 63 dealers or firms in 30 cities in 10 different states reported improvement in packing and marketing Virginia apples. The foreign representative of the Bureau of Agricultural Economics advised that "as a result of the law and its enforcement, it can be said that Virginia's reputation in foreign markets is most assuredly on the upgrade." It is believed by the authorities that at least 50 per cent more Virginia apples were properly graded and containers properly marked than would have been the case without the enforcement of the Virginia Apple Grading and Marking Law.

Several states, after making definite surveys, have concluded that faulty packing of apples and other fruit tends to restrict sales in city markets. Preference has been given to apples from sections where grading and marking are receiving careful attention. In other words, it appears that growers and shippers are doing themselves an injury by not devoting time and effort to these important matters.

Production Figure Increased

The December estimate of the commercial apple crop was raised to 35,308,000 barrels, or 900,000 more than were expected in November. Last season's commercial production of apples was about 26,000,000 barrels. Principal changes during November were increases of 700,000 and 200,000 barrels respectively in Virginia and West Virginia and 240,000 barrels in Idaho. But those gains were partly offset by a decrease of 335,000 barrels in the estimate for Washington. That state (Washington) is still credited with a huge market crop of 10,000,000 barrels or 30,000,000 boxes. Though the unit price of apples this season is about one-fourth below that of 1927, total farm value of the crop is estimated at $185,000,000, compared with $171,000,000 in 1927. The season's shipments are forecast at 127,000 cars, as against 93,000 during the 1927-28 season. About 100,000 had been shipped by January 5. Western states were credited with 50,000 cars, compared with 37,800 a year ago and 48,700 all of last season. Eastern shipping areas had also forwarded 50,000 cars by January 5, as against 37,500 to the same time in 1928 and a total of 44,400 last season.

Best Baldwins and Rhode Island Greenings from western New York cold storage were selling on an f. o. b. basis at $5-$5.25, and these barreled apples brought $5-$6 in city markets. McIntosh sold as high as $12 in New York City. Eastern Staymans ranged $4-$5 in large distributing centers, with Yorks touching $5.50. Chicago dealers got $5.50-$7.50 on midwestern Jonathans. Michigan Spys sold at $6-$9 in Chicago. Northwestern boxed apples, Extra Fancy grade, medium to large sizes, were jobbing in that market at $2.25-$3.50, according to variety, while shippers in the state of Washington reported Winesaps at $1.65-$1.75 and Delicious at $2.50.

Storage Stocks Decreasing

Supplies of apples in commercial cold storage houses were being rapidly reduced. By January 1, the holdings were 2,350,000 barrels, 15,428,000 boxes, and 4,233,000 bushel baskets. The combined holdings in cold storage were only eight per cent above the five-year average for January 1 but 30 per cent heavier than a year ago. Stocks in barrels showed an increase of 39 per cent over the figures for January, 1928, though they were 32 per cent below the average holdings of barreled fruit. Boxes in cold storage houses were about 26 per cent more plentiful than a year ago and showed a similar gain over the five-year average. About 10,368,000 boxes of the total supply in this container were still in Pacific Coast states. Holdings of bushel baskets registered an increase of about one-third over the report for January 1, 1928, and were 106 per cent greater than the average figure.

Apples in Foreign Markets

Barreled apples from America have been in much greater demand than boxed stock this season in British markets. This is not only because of heavy crops in the West and a relatively light production in the East, but also because of the eastern shortage of small sizes, most desirable for export trade. Prices of boxed fruit have been low enough to permit some importers to secure their own supplies directly from the United States. For barreled apples, however, they have had to depend largely on consignments, according to reports from the department's fruit specialist in London. Retail prices of both boxed and barreled fruit are more closely alike than they have been for years, or around eight cents per pound.

On January 2, the Liverpool auction market ranged mostly $5.60-$6.80 per barrel of best eastern apples from America, while Extra Fancy western fruit brought $2.50-$3.40 per box, according to variety. A great part of the supply of barreled apples was of inferior quality or condition. Good stock was in demand and brought quite a premium. Local reports indicate that this year's apple crop in Australia and New Zealand may be short. Tasmania also expects a light crop. Orders are being booked at relatively high prices, and this entire situation may enhance the opportunities for American exporters. During the closing week of December, exports from United States and Canada were 120,720 barrels and only 85,540 boxes, compared with 55,000 barrels and 229,000 boxes during the same period in 1927.

Citrus Production Increased

As might be expected from the heavier production of citrus fruits this season, prices to growers are somewhat below those of December, 1927. The 1928 crop of oranges in California, Florida and Louisiana is expected to total 43,220,000 boxes, which would amount to an increase of 38 per cent over the crop of 31,400,000 boxes picked in 1927. Judging by prices so far received for the 1928 crop, the value may exceed that of the 1927 crop by less than three per cent, being estimated at $128,760,000, compared with $125,400,000 for the 1927 crop. California expects 31,000,000 boxes of oranges, or 8,000,000 more than last season, and Florida's probable crop of 12,000,000 boxes will be an increase of nearly 50 per cent over the 1927 total. About 21,100 cars of oranges had been shipped by January 5, as against 17,200 a year ago. California's excess over last season's corresponding record is even greater than the Florida excess. Alabama and Louisiana, however, were lagging behind.

The expected 1928 production of grapefruit in California, Florida, Texas and Arizona is 9,736,000 boxes, compared with a 1927 crop of 8,586,000 boxes. In Florida and California, where the bulk of the crop is produced, prices to December 1 indicate that the value of the 1928 crop may be approximately $23,200,000 or seven per cent lower than the $25,056,000 received for the 1927 crop. Florida may have 8,000,000 boxes of grapefruit, compared with 7,200,000 last sea-

son, and on December 1 the average farm price was $2.55, or one-sixth less than the year before. California expects 800,000 boxes of grapefruit, just one-tenth as many as Florida. Production in Texas may amount to 750,000 boxes, a gain of 50 per cent over 1927. With 7030 cars shipped by January 5, Florida was running fully one-fourth ahead of its corresponding record of the 1927-28 season. The clearing house, now in operation in Florida, began to pro-rate shipments about January 1, to prevent excessive market supplies. Movement was being allotted on the basis of past volume of the interested shippers.

Orange Industry Studied

The United States is the leading orange-producing nation of the world, the average annual production in this country being approximately 34,000,000 boxes. A national railway organization, specializing in statistical studies, has issued a report, including the following interesting data:

"California, the largest producing state, accounts for 67 per cent of the total: Florida produces 32 per cent, and five other states—Alabama, Arizona, Louisiana, Mississippi and Texas—together account for the remaining one per cent. More than 72,000 carloads of oranges were shipped out of the producing areas during the year ended on September 30, 1927, while of that total more than 50,700 cars were unloaded in 66 important markets. Of these unloads, 73 per cent were distributed in 31 markets located in the territory lying east of the Mississippi River and north of the Ohio River and the southern border of Pennsylvania, while an additional 9.5 per cent were unloaded in eight markets located relatively close to that territory. Long hauls predominate in the transportation of oranges to consuming markets. To reach the 66 markets, approximately 58 per cent of the total unloads traveled distances ranging from 2000 to 3500 miles; about 34 per cent traveled from 1000 to 2000 miles, and eight per cent traveled less than 1000 miles.

"Prices of oranges varied periodically in all phases of the marketing process. In the four largest consuming markets—New York, Boston, Philadelphia, and Chicago—where wholesale and retail prices for the 1926-27 season were studied, large daily, weekly, monthly and seasonal variations in prices of oranges occurred. These variations were usually many times the freight rates from producing area to market. The greater part of the oranges produced in the United States is consumed in this country. Nevertheless, the exports are of considerable importance. During the five calendar years, 1923 to 1927, the average annual exports amounted to 2,618,655 boxes, of which Canada received 2,228,272 boxes, or 85.1 per cent, and the United Kingdom, 206,026 boxes or 7.9 per cent. The remaining 184,357 boxes, or seven per cent, were distributed to over 40 different countries. The increase in shipments to the United Kingdom in these five years has been remarkable, there having been shipped in 1923 only 46,046 boxes to this destination, compared with 604,334 boxes in 1927."

Flour from Apples

EXPERIMENTS are reported of the manufacture of flour from apples in the Pacific Northwest, and it is felt in some quarters that this project will show considerable development. It requires seven tons of apples to make one ton of flour. A baking company is now making and selling cookies manufactured from this by-product. Shipments have gone as far east as Chicago, and the cookies seem to meet with favor. Because the apple flour contains no gluten, much experimentation was necessary to determine the right percentage of wheat flour to combine with the apple product in order to bake properly.

Super Economy

A Scotchman was leaving on a business trip and he called back as he was leaving:

"Goodbye, all, and dinna forget to tak' little Donal's glasses off when he isn't looking at anything."

A PROMISING NEW SPRAY for PEACHES

LESLIE PIERCE, United States Bureau of Plant Industry worker, has found a promising control for *Bacterium pruni*, a serious disease of peaches. In Knox county, Indiana, alone, the yearly injury has been estimated at $50,000. This disease has baffled investigators and growers in practically all states where peaches are grown.

A summary of the situation was given by Dr. Pierce at the annual meeting of the Indiana Horticultural Society held at Indianapolis.

"A spray composed of four pounds of zinc sulphate, three pounds of hydrated lime and one-half pound of casein lime to 50 gallons of water has given the best results. Zinc sulphate costs about the same as copper sulphate or bluestone used in making Bordeaux mixture. Hydrated lime and casein lime are common ingredients of spray already known to growers. It is a very cheap spray," Dr. Pierce told his hearers.

During the season this spray should be applied at two-week intervals, beginning at petal fall time. Particular care must be taken to cover the fruits and under side of the leaves.

In addition to greatly reducing the infections on both fruit and leaves, the spray seemed to stimulate the growth of leaves. No injury was noted on leaves, twigs or fruit when the spray was used alone. It is not known whether the spray can be successfully combined with arsenate of lead.

This spray has been used with success in the experimental orchard at Vincennes, in the John Dyer orchard, Simpson orchards and Dixie Orchards, all in Knox county, Indiana. It is heralded by pathologists and growers as the most outstanding piece of work done for several years.

Midwest Spray Schedule

By T. J. TALBERT
University of Missouri

APPLES, PEARS AND QUINCES

1. Dormant or delayed dormant. Generally most satisfactory just as blossom buds are swelling in spring. Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., water to make 100 gal, for San Jose scale and other scale insects. Proprietary miscible oils should be used at dilution recommended by manufacturers.

Special spray. When buds are opening and aphid eggs are hatching. Oil emulsion 3 gal. in 4-6-100 Bordeaux, for plant lice (aphids), San Jose scale and apple scab.

2. Cluster bud spray. When buds begin to separate but before they open. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for apple scab, leaf spot, curculio, canker worm. Add 1 pt. to 1½ pts. nicotine sulphate when aphids are serious.

3. Second summer or calyx spray. Start when bloom is two-thirds off and finish before blossom ends close. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for codling moth, plant lice (aphids), curculio, canker worm, apple scab, black rot, leaf spot. Most important summer spray. Should be applied within a week after petals fall to be most effective.

4. Third summer spray. Within 12 or 14 days after calyx spray. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot. Where apple blotch or phoma spot is serious, use 4-6-100 Bordeaux instead of lime-sulphur.

5. Fourth summer spray. Twelve to 14 days after No. 4. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot, sooty blotch. Where apple blotch or phoma spot is serious, use 4-6-100 Bordeaux instead of lime-sulphur.

6. Fifth summer spray. Twelve to 14 days after No. 5. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot, sooty blotch, bitter rot. Where apple blotch or phoma spot is serious, use 4-6-100 Bordeaux instead of lime-sulphur.

7. Sixth summer spray. Twelve to 14 days after No. 6. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot, sooty blotch, bitter rot. Make later sprays at intervals of 12 to 14 days when required for codling moth or bitter rot control.

Dusting Apples, Pears and Quinces. Comparatively few growers are now using dusts on these fruits because experience and observations have generally shown that where either diseases or insects are serious, liquid sprays usually give better results. Nevertheless, there has recently been a revival of interest in dusts in the central states. The best that the Missouri Agricultural Experimental Station can say at this time, however, is that dusts may profitably supplement liquid sprays in orchards large enough to justify the purchase of both liquid and dust sprayers. The dust applications may be made quickly between liquid applications and thus may tend to lessen the damage from both insects and diseases. It would be a serious mistake for the grower to rely wholly upon dusts. The dormant sprays must consist of a liquid application, and where apple blotch is serious, dusts have not as yet proved nearly as effective as Bordeaux.

PEACHES, APRICOTS AND NECTARINES

(See also dust schedule immediately following spray schedule.)

1. Dormant spray. Any time after leaves drop in fall and before buds swell in spring. Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., in 4-6-100 Bordeaux, for San Jose scale, other scale insects, peach leaf curl. When scale is absent, use 6-8-100 Bordeaux or lime-sulphur 7 gal., water to make 100 gal., for control of peach leaf curl. Apply before buds start.

2. First summer spray. As husks or calyces fall, usually about 4 to 7 days after bloom drops. Dry-mix sulphur lime 25 lbs., arsenate of lead 2 lbs., water 100 gal., for curculio, brown rot. Where brown rot is not serious, very good results may be secured from spray made of 8 lbs. lime, 2 lbs. arsenate of lead to 100 gal. water.

3. Second summer spray. About 10 to 12 days after No. 2. Dry-mix sulphur lime 25 lbs., arsenate of lead 2 lbs., water 100 gal., for scab, brown rot, curculio. Dry-mix sulphur lime is generally the most satisfactory spray for peaches.

4. Third summer spray. About 10 to 12 days after No. 3. Dry-mix sulphur lime 25 lbs., arsenate of lead 2 lbs., water 100 gal., for scab, brown rot, curculio. Where scab and leaf curl are absent, sprays Nos. 2 and 3 will often be sufficient for early peaches. Varieties like Elberta, Heath Cling and Krummel may require 2 or 3 additional sprays made at intervals of about 10 to 12 days.

5. Fourth summer spray. About 10 to 12 days after No. 4. Dry-mix sulphur lime 25 lbs., arsenate of lead 2 lbs., water 100 gal., for scab, brown rot, curculio. During rainy seasons additional sprays may be required at intervals of 10 to 12 days up to within 4 or 5 weeks of harvest time.

SOUR CHERRIES AND AMERICAN PLUMS

(See also dust schedule immediately following spray schedule.)

1. Dormant spray. Just before buds swell in spring. Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., water to make 100 gal., for San Jose scale, cherry scale. When scale is absent, dormant spray may be omitted.

2. First summer spray. Just before blossom buds open. Lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for curculio, brown rot, leaf spot. Lime-sulphur does less injury and gives much better finish to appearance of fruit and foliage.

3. Second summer spray. As husks or calyces fall. Lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for curculio, brown rot, leaf spot. Bordeaux may give better control of leaf spot during wet seasons.

4. Third summer spray. About 10 to 12 days after No. 3. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for curculio, brown rot, leaf spot. A less number or additional sprays may be required, depending on severity of diseases, curculio and kind of weather.

5. Fourth summer spray. Soon after harvesting fruit. Lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for leaf spot, leaf eating insects. For Japanese plums like Burbank, Abundance, Chebot, etc., use peach spray in same proportions, as it is less likely to do injury to fruit and foliage.

GRAPES

1. Dormant spray. Few weeks before growth starts in spring. Lime-sulphur 14 gal., water to make 100 gal., for grape scale, San Jose scale, anthracnose, black rot. If scale is absent, use 6-8-100 Bordeaux for anthracnose and black rot.

Special bud spray. As buds are swelling. Arsenate of lead 6 lbs., lime 8 lbs., water 100 gal., for grape flea beetle. If beetles are serious, repeat spray in 5 to 7 days.

2. First summer spray. When shoots are showing second or third leaf. Bordeaux 4-6-100, arsenate of lead 6 lbs., for black rot, anthracnose, flea beetle, rose chafer, curculio. Lime-sulphur solution not used as a spray for grapes on account of injury it may do to fruit and foliage.

3. Second summer spray. Just before blossoms open. Bordeaux 4-6-100, arsenate of lead 4 lbs., for black rot, anthracnose, curculio, flea beetle, berry moth, rose chafer. For grape climbing cut worm, use poison bran mash, sowing it broadcast on ground under vines in evening.

4. Third summer spray. About 10 to 12 days after No. 3, or when bloom is off. Bordeaux 4-6-100, arsenate of lead 4 lbs., for black rot, anthracnose, downy mildew, powdery mildew, curculio, grape root worm. Thorough and timely applications required in successful grape culture.

5. Fourth summer spray. About 10 to 14 days after No. 4. Bordeaux 4-6-100, arsenate of lead 4 lbs., for black rot, anthracnose, downy mildew, powdery mildew, curculio, grape root worm. Perhaps more beginners in grape growing fail on account of improper spraying than from all other causes.

6. Fifth summer spray. About 10 to 14 days after No. 5. Bordeaux 4-6-100, arsenate of lead 4 lbs., for black rot, anthracnose, downy mildew, powdery mildew, curculio, grape root worm. It is important that spraying be discontinued 5 to 6 weeks before harvest, otherwise fruit may be badly stained.

7. Sixth summer spray. About 10 to 14 days after No. 6. Bordeaux 4-6-100, arsenate of lead 4 lbs., for black rot, anthracnose, downy mildew, powdery mildew, curculio, grape root worm. In vineyards where diseases and insects are not serious, 3 or 4 of the earlier sprays may be sufficient.

BLACKBERRIES, RASPBERRIES AND DEWBERRIES

1. Dormant spray. Just before growth starts in early spring. Lime-sulphur 14 gal., water to make 100 gal., for scale insects. Canes should be tied up to trellis before making application.

2. First summer spray. When new shoots are 8 to 10 in. long. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for anthracnose, leaf roller, sawfly. Arsenate of lead may be omitted when insects are not present.

3. Second summer spray. Just before blossoms open. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for anthracnose, leaf roller, sawfly. Arsenate of lead may be omitted when insects are not present.

4. Third summer spray. Immediately after harvest. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for anthracnose, leaf roller, sawfly. Apply spray after removal of old canes.

STRAWBERRIES

1. First summer spray. Soon after growth starts in spring. Bordeaux 4-6-100, arsenate of lead 4 lbs., for crown borer, leaf roller, slugs, weevils, leaf spot, flea beetle. Fields started with healthy plants and fruited no longer than 2 years are not likely to need spraying.

2. Second summer spray. About 10 to 12 days after No. 1. Bordeaux 4-6-100, arsenate of lead 4 lbs., for leaf roller, slugs, other foliage-eating insects, leaf spot, mildew. Thorough spraying important.

3. Third summer spray. Just as plants begin to bloom. Bordeaux 4-6-100, arsenate of lead 4 lbs., for leaf roller, slugs, other foliage-eating insects, leaf spot, mildew. Where insects and diseases are not serious, this spray may be omitted.

4. Fourth summer spray. After renewal following harvest. Bordeaux 4-6-100, arsenate of lead 4 lbs., for leaf roller, slugs, other foliage-eating insects, leaf spot, mildew. Important spray where insects and diseases are serious.

CURRANTS AND GOOSEBERRIES

1. Dormant spray. While dormant in fall, winter or spring. Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., water to make 100 gal., for scale insects. When scale is absent, this spray may be omitted.

2. First summer spray. When leaves are unfolding. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for leaf spot, mildew, anthracnose. Where diseases are serious, Bordeaux is suggested instead of lime-sulphur.

3. Second summer spray. Soon after fruit is set. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for leaf spot, mildew, aphids, currant worms. If aphids are serious, add 1 pt. nicotine sulphate to 100 gal.

4. Third summer spray. About 10 to 14 days after No. 3. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for leaf spot, mildew, aphids, currant worms. If dis-

eases are serious, use 4-6-100 Bordeaux, arsenate of lead 2 lbs.

5. **Fourth summer spray.** After fruit is picked. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal.; or 4-6-100 Bordeaux, arsenate of lead 2 lbs., for leaf spot, anthracnose, leaf-eating insects. This spray not needed unless diseases and insects are serious.

POINTERS ON OIL SPRAYS

The lubricating oil emulsions are not recommended as fungicides. There is no evidence that they have any fungicidal value. When mixed with Bordeaux 4-6-100, however, the combination spray becomes a fungicide as well as an insecticide.

1. For the effective control of scale, liquid lime-sulphur, the lubricating oil emulsions, or miscible oils may be used. If there is any slight advantage in the matter of scale control, it is on the side of the oils.

2. From the standpoint of scale alone, the lubricating oil emulsion sprays are the cheaper.

3. From the point of view of possible injury to fruit trees, lime-sulphur has a decided advantage, as it has never caused injury when applied on dormant trees. However, the oil emulsions are being used extensively for dormant sprays and if the emulsions are properly prepared and diluted, evidence to date indicates that they can be safely used on dormant trees.

4. Use Bordeaux 4-6-100 with every tank of engine oil-soap emulsion. Stock emulsions in which free oil has separated out and come to the surface, due to freezing or any other cause, should not be used. Do not use a dilute spray mixture in which free oil has separated out and come to the surface of the tank. Stir all stock emulsions before measuring for use.

5. Careful experiments and observations in Missouri have shown that San Jose scale can be effectively controlled with lime-sulphur, lubricating oil emulsion and proprietary miscible oils. A very thorough application is necessary and each spray must be used at the proper dilution. As many growers have failed to control scale with oil sprays as with lime-sulphur spray. It is not, therefore, so much a matter of which spray to use as it is of thorough spraying at the right dilution. One good dormant application each year should keep scale well under control and prevent injury to fruit and trees.

Midwest Dust Schedule

PEACHES, APRICOTS, NECTARINES, CHERRIES AND PLUMS

(See also liquid spray schedule immediately preceding.)

1. Dormant spray. Dust not advised. Use liquid sprays.

2. First summer dust. When about 75% of petals have fallen. 95-5 sulphur-lead arsenate dust, for curculio, brown rot, cherry leaf spot. Only finely ground and specially prepared sulphur and arsenicals are satisfactory.

3. Second summer dust. When calyces or shucks are shedding or about 4 to 7 days after blossoms drop. 95-5 sulphur-lead arsenate dust, for curculio, brown rot, peach scab, cherry leaf spot.

Special dust. About 7 days after No. 3. 95-5 sulphur-lead arsenate dust, for curculio, brown rot, peach scab, cherry leaf spot. This application not required unless curculio is serious.

4. Third summer dust. About 10 to 12 days after No. 3. 95-5 sulphur-lead arsenate dust, for curculio, brown rot, peach scab, cherry leaf spot. Dust applications are in general more satisfactory for stone fruits than for apples and other pome fruits. This is particularly true for the peach.

5. Fourth summer dust. About 10 to 12 days after No. 4. 95-5 sulphur-lead arsenate dust, for curculio, brown rot, peach scab, cherry leaf spot. Additional dustings at intervals of 10 to 12 days may be needed until within about 3 or 4 weeks of harvest.

The Florida Schedule

By W. L. FLOYD
University of Florida

CITRUS

1. Before new growth unfolds on grapefruit and satsumas. Bordeaux 6-6-100, oil emulsion 1%, for scab.

2. When spring growth starts on any variety of citrus. Nicotine sulphate 1 pt., soap 5 lbs., water 100 gal., for aphids. Bend over and dip ends of infected branches in a bucket of this solution. After 15 days, if aphids are still present, dust with lime 97%, nicotine sulphate 3%. Repeat once a week as long as aphids are numerous.

3. Just before petals open on grapefruit and satsumas. Lime-sulphur, for scab. This spray will also destroy any rust mites and red spiders present.

4. Soon after petals have fallen from grapefruit and satsumas. Bordeaux-oil, for scab, melanose.

5. When fruit is about 1 in. in diameter on all varieties of citrus. Oil emulsion 1%, dry soda-sulphur 2½ lbs., for white fly, scale insects, rust mites.

6. About June. Spray with lime-sulphur 2 gal., water to make 100 gal., or dust with flowers of sulphur, for rust mites, red spider. Watch for these pests and repeat applications as often as necessary to keep them in control.

7. October or November. Repeat spray No. 5 as a clean-up for the winter.

AVOCADOS

1. In March during latter part of blooming period. Bordeaux 6-6-100, for scab. This application should be repeated in about 3 weeks for scab and black spot. Spray again in about 3 weeks if it seems necessary for black spot and blotch.

2. In October, as foliage begins to harden. Oil emulsion 1%, for scale insects, white fly.

3. November to March. Lime-sulphur 1⅔ gal., nicotine sulphate 1 pt., water to make 100 gal., for leaf thrips, lace bugs, red spider.

MANGOES

1. When in bloom. Arsenate of lead 3 lbs., 6-6-100 Bordeaux, for anthracnose, blossom anomala.

2. November to March. Lime-sulphur 1⅔ gal., nicotine sulphate 1 pt., water to make 100 gal., for red spider, leaf thrips.

3. December to February, when trees are dormant. Oil emulsion, for scale insects.

New York Spray and Dust Schedule

By Entomologists and Plant Pathologists of New York State Agricultural Experiment Station and New York State College of Agriculture

SPRAY AND DUST SCHEDULE FOR APPLES

1. Delayed dormant. When leaves of blossom buds are out ¼ to ½ in. Spray with lime-sulphur 2½ gal. (use 11 gal. when San Jose scale is present), arsenate of lead 2½ lbs., nicotine sulphate ⅔ pt., water to make 100 gal., for scab, scale, blister mite, bud moth, leaf roller, case-bearers, aphids. Dust with 90-10 sulphur-lead arsenate dust, for scab, bud moth, leaf roller, case-bearers, aphids. No satisfactory dust for scale or blister mite.

2. Pre-blossom. Two applications between delayed dormant and calyx periods may be used in a rainy season. Spray with lime-sulphur 2½ gal., arsenate of lead 2½ lbs., water to make 100 gal., or dust with 90-10 sulphur lead arsenate dust, for scab, green fruit worms, bud moth, leaf roller, case-bearers. If conditions are favorable for a bad outbreak of scab, spray as much as possible, using dust to complete the operation on time. In combating rosy aphis with dust, the most promising means of control is a heavy application of a mixture containing not less than 2% nicotine as blossom buds begin to show pink.

3. Calyx. When last of petals are falling. Spray with lime-sulphur 2½ gal., arsenate of lead 2½ lbs., water to make 100 gal., or dust with 90-10 sulphur-lead arsenate dust, for scab, codling moth, green fruit worms, bud moth, curculio, lesser apple worm. If red bug is present, add 1 pt. nicotine sulphate to the spray, or dust with 2% nicotine dust. If conditions are favorable for a destructive outbreak of scab, spray as much of orchard as possible, using dust in a supplementary capacity.

4. Later sprays. To be determined by weather conditions affecting development of scab and codling moth. Lime-sulphur 2½ gal., arsenate of lead 2½ lbs., water to make 100 gal., or dust with 90-10 sulphur-lead arsenate dust for scab, codling moth, curculio, lesser apple worm, apple maggot. During prolonged rainy periods, it is advisable to make applications of dust at shorter intervals than indicated for spray mixtures. If foliage injury from the use of lime-sulphur is feared, the most satisfactory alternative is the wettable sulphur spray as described in Note 1.

SPRAY AND DUST SCHEDULE FOR CHERRIES

1. Delayed dormant. When bud scales separate and expose green blossom buds. (For sweet cherries only.) Spray with lime-sulphur 11 gal., nicotine sulphate ⅔ pt., water to make 100 gal., for scale, aphids; or nicotine sulphate ⅔ pt., soap 5 or 6 lbs., water to make 100 gal., for aphids only. No satisfactory dust for scale. Thorough dusting with 3% nicotine dust should reduce number of insects.

2. Just before blossoms open. Spray with lime-sulphate 2½ gal. (sweet cherries 2 gal.) water to make 100 gal., or dust with dusting sulphur, for brown rot, blossom blight.

3. When petals fall. Spray with lime-sulphur 2½ gal. (sweet cherries 2 gal.), arsenate of lead 2½ lbs., water to make 100 gal., or dust with 90-10 sulphur-lead arsenate dust, for leaf spot, brown rot, curculio. If curculio is abundant, dust with 80-20 sulphur-lead arsenate dust.

4. Ten days after petals fall or when shucks

(*To foot of next page*)

Spray Schedule for New England

By BROOKS D. DRAIN
Massachusetts Agricultural College

APPLES

1. Delayed dormant application. Early spring as buds are breaking. Oil emulsion 4 to 5 gal. (3% actual oil), water to make 100 gal.; or lime sulphur 12 gal., 40% nicotine sulphate ¾ pt., water to make 100 gal., for San Jose scale, European red mite (eggs), aphids, blister mite. Oil emulsion is cheaper than lime-sulphur with nicotine sulphate, and is more efficient in controlling European red mite.

2. Pink spray. As blossom buds begin to show pink. Lime-sulphur 2 gal., arsenate of lead 3 lbs., 40% nicotine sulphate 1 pt., water to make 100 gal., for red bug, scab, curculio, aphids, tent caterpillar, bud moth, brown tail moth, gypsy moth, canker worms. In areas where gypsy moth is troublesome, double the amount of arsenate of lead. This is a very important spray in New England.

3. Calyx spray. Within a week after petals fall. Same materials as for pink spray, for codling moth, curculio, scab, red bug, aphids, gypsy moth, skeletonizer. This application generally regarded as the most important single spray.

Special sprays. There are few locations where the three applications listed above will not give excellent returns on their cost. In addition, most orchards will need one or more of the following sprays:

1. Pre-pink spray. Lime-sulphur 2 gal., water to make 100 gal., for scab on very susceptible varieties like McIntosh.

2. Special spray for plum curculio. Apply a week or 10 days after calyx spray. Arsenate of lead 3 lbs., water to make 100 gal. This spray is also effective against late-emerging codling moth. If scab is developing, add 2 gal. lime-sulphur.

3. Special spray for "side worm injury." Recent studies indicate that the so-called "side worm injury" is due to late-emerging codling moth. Use same materials as in special plum curculio spray above, and apply 3 or 4 weeks after calyx spray.

4. Apple maggot spray. This comes during first week in July, varying somewhat in different seasons. Arsenate of lead 3 lbs., lime-sulphur 2 gal., water to make 100 gal., for apple maggot, Brooks spot, sooty fungus, scab, skeletonizer.

Notes. Some growers are using dust in place of liquid sprays to reduce spray injury during hot, humid weather in mid-summer. Small growers often prefer dry lime-sulphur in place of liquid lime-sulphur because of its convenience in handling.

SOUR CHERRIES

1. Immediately after blossoms fade. Lime-sulphur 2 gal., arsenate of lead 3 lbs., water to make 100 gal., for brown rot, leaf spot, curculio. If aphids are numerous, add 1 pt. 40% nicotine sulphate to 100 gal. of solution.

2. Just after shucks fall. Same materials as in No. 1. This spray very important in control of brown rot, leaf spot, curculio.

3. Just before fruit turns red. Lime-sulphur 2 gal., water to make 100 gal., for brown rot, leaf spot. If this application is delayed, spray stains will show on ripe fruit.

4. Immediately after fruit is picked. Lime-sulphur 2 gal., water to make 100 gal., for cherry leaf spot.

PLUMS (Japanese Varieties)

(See Note 2 for European varieties,)

1. Just as shucks begin to fall. Dry-mix sulphur lime 25 lbs., arsenate of lead 3 lbs., water to make 100 gal.; or arsenate of lead 3 lbs., 16-16-100 self-boiled lime-sulphur, for brown rot, plum curculio, leaf spot. A dust of sulphur 85 parts, arsenate of lead 15 parts, may be used in place of liquid spray.

2. Ten days to 2 weeks after No. 1. Same materials as in No. 1. This application very important in curculio control; also used for ske'etonizer, brown rot, leaf spot. Same dust materials as for No. 1 may be used.

(*To foot of next page*)

New York Spray & Dust Schedule

(*From preceding page*)

are off. Spray with lime-sulphur 2½ gal. (sweet cherries 2 gal.), arsenate of lead 2½ lbs., water to make 100 gal., or dust with 90-10 sulphur-lead arsenate dust, for leaf spot, brown rot, curculio. If curculio is abundant, dust with 80-20 sulphur-lead arsenate dust.

5. For all varieties when Early Richmond cherries show red on one side. Spray with lime-sulphur 2½ gal. (sweet cherries 2 gal.), arsenate of lead 2½ lbs., water to make 100 gal., or dust with 90-10 sulphur-lead arsenate dust, for maggot, leaf spot, brown rot. If rains are of frequent occurrence, apply a dust about 1 week after application made when Early Richmond cherries show red on one side. Then about a week later, apply another dust.

6. For all varieties when Montmorency cherries show red on one side. Spray with lime-sulphur 2½ gal., (sweet cherries 2 gal.), arsenate of lead 2½ lbs., water to make 100 gal., or dust with 90-10 sulphur-lead arsenate dust, for maggot, leaf spot, brown rot. If rains are of frequent occurrence, apply a dust about 1 week after application made when Early Richmond cherries show red on one side. Then about a week later, apply another dust.

7. After picking. Spray with lime-sulphur 2½ gal. (sweet cherries 2 gal.), arsenate of lead 1 lb. to 2 lbs., water to make 100 gal., or dust with dusting sulphur, for leaf spot.

GRAPE SPRAY SCHEDULE FOR FINGER LAKES REGIONS

1. About 1 week before blossoms open. Bordeaux 8-8-100, for black rot, mildew, and if larvae of flea beetle are present, add 3 lbs. arsenate of lead. If black rot has been severe in past years, make an early aplication when the second or third leaf is showing, using Bordeaux 8-8-100.

2. As soon as berries set. Bordeaux 8-8-100, for black rot, mildew, flea bettle.

3. Two weeks later. Subsequent applications to be determined by weather conditions and the previous control of black rot and mildew. Bordeaux 8-8-100, for black rot, mildew.

Grape leaf hopper may be controlled by very thorough spraying, using the following formula: Bordeaux 8-8-100, nicotine sulphate 1 pt. The application should be made soon after July 4 when newly hatched nymphs are on the leaves. An upturned nozzle must be used and care taken to hit the insects. Unless the leaf hoppers are extremely abundant, a special spray for this insect is not likely to be profitable.

GRAPE SPRAY SCHEDULE FOR CHAUTAUQUA GRAPE REGION

1. Just as soon as fruit has set. Make special effort to place spray on clusters. Arsenate of lead 3 lbs., resin fish-oil soap 3 lbs., 8-8-100 Bordeaux, for berry moth, powdery mildew. This is a special berry moth spray and can be omitted if the pest is not present.

2. When root worm beetles first appear in numbers. Usually from a week to 10 days after fruit has set. Arsenate of lead 3 lbs., resin fish-oil soap 3 lbs., 8-8-100 Bordeaux, for root worm, berry moth, powdery mildew.

3. Ten days to 2 weeks later. Arsenate of lead 3 lbs., resin fish-oil soap 3 lbs., 8-8-100 Bordeaux, for root worm, berry moth, powdery mildew.

4. When maximum number of leaf hopper nymphs are present, usually between July 12 and 20. Nicotine sulphate ¾ pt., resin fish-oil soap 3 lbs., water 100 gal., or hydrated lime 8 lbs., water 100 gal., for leaf hopper. During certain seasons this spray can be combined with the preceding one.

5. Special rose chafer spray. Apply as soon as beetles appear. Confectioners' glucose 25 lbs. or cheap molasses 2 gal., arsenate of lead 5 lbs., water to make 100 gal., for rose chafer.

PEARS

1. Dormant. Early in spring when adult thrips first appear on buds, just as bud scales begin to separate. Miscible oil 5 gal., nicotine sulphate 1 pt., water to make 100 gal., for thrips. Lubricating oil emulsion (3% oil), for psylla (to kill overwintering flies and prevent egg laying).

2. Cluster bud. When cluster buds have separated (Bartlett); when they begin to separate (Kieffer). Lime-sulphur 11 gal., water to make 100 gal., for scale, scab, psylla eggs.

3. Calyx. Just after petals fall. Lime 30 to 40 lbs., copper sulphate 2 lbs., arsenate of lead 2½ lbs., nicotine sulphate 1 pt., water to make 100 gal., for codling moth, psylla nymphs, scab. Lime-sulphur solution is not advised at this time because of danger of foliage injury. For those who do not wish to use the lime-copper sulphate mixture, the wettable sulphur spray as described in Note 1 is recommended. Nicotine sulphate 1 pt., arsenate of lead 2½ lbs., and hydrated lime 32 lbs., should be added to each 100 gal. to kill psylla and dry up the honey dew.

4. About 2 weeks after petals fall. Lime-nicotine dust (2% nicotine), for psylla flies. For scab susceptible varieties, use Bordeaux 6-20-100.

5. Emergency application in summer when psylla become abundant. Lime 30 to 40 lbs., copper sulphate 2 lbs., nicotine sulphate 1 pt., water to make 100 gal., for psylla nymphs, scab. For psylla flies, use lime-nicotine dust (2% nicotine).

SPRAY AND DUST SCHEDULE FOR PEACHES

1. Late fall or early spring, before buds swell. If scale is abundant, spray with lime-sulphur 11 gal., water to make 100 gal., for San Jose scale, leaf curl. If scale is not important, spray with lime-sulphur 6½ gal., water to make 100 gal., for leaf curl. Dust not advised.

2. When blossoms show pink. Spray with wettable sulphur (Note 1), or dust with dusting sulphur, for blossom blight, brown rot.

3. When shucks are falling. Spray with wettable sulphur (Note 1), arsenate of lead 2 lbs., or dust with dusting sulphur for brown rot, scab, curculio.

4. Two or 3 weeks after shucks fall. Spray with wettable sulphur (Note 1), or dust with dusting sulphur for brown rot, scab.

5. Two to 4 weeks before fruit ripens. Spray with wettable sulphur (Note 1), or dust with dusting sulphur for brown rot, scab.

SPRAY AND DUST SCHEDULE FOR PLUMS

1. While buds are dormant. Spray with lime-sulphur 11 gal., water to make 100 gal. (all varieties), for scale. Dust not advised.

2. When shucks are off young fruits. Spray all varieties except Japanese with lime-sulphur 2 gal., arsenate of lead 2½ lbs., water to make 100 gal., or dust all varieties with 85-15 sulphur-lead arsenate dust, for leaf spot, brown rot, curculio.

3. From 14 to 20 days later. Spray all varieties except Japanese with lime-sulphur 2 gal., water to make 100 gal., or dust all varieties with dusting sulphur or 95-5 sulphur-lead arsenate dust, for leaf spot, brown rot.

4. Before fruit ripens. Spray all varieties except Japanese with lime-sulphur 2 gal., water to make 100 gal., or dust all varieties with dusting sulphur, for leaf spot, brown rot.

Japanese Varieties: On these varieties follow the same schedule as to time of spraying. For the application when the buds are dormant, use lime-sulphur 11 gal., water to make 100 gal., as directed above. For subsequent applications, instead of lime-sulphur solutions, use wettable sulphur (Note 1) or self-boiled lime-sulphur. For dust applications, use same materials as for other varieties.

Note 1. For making the wettable sulphur spray, 8 lbs. hydrated lime, 16 lbs. superfine sulphur and 8 oz. calcium caseinate are used in 100 gal. water. The materials can be mixed dry during the winter or during rainy weather and stored for use. It is prepared in the spray tank as follows: Fill the tank half full of water; then, with agitator running, add the dry materials slowly, directing the spray nozzle upon the material until it has all disappeared in the water.

Arsenate of Lead. The amount of arsenate of lead is given in these schedules for powder form; if paste form is used, double the amount.

Lime-sulphur. The directions for lime-sulphur are based on the standard strength 32 to 34 degrees Baume solution.

Schedules for the Southeast

By OLIVER I. SNAPP
United States Department of Agriculture

PEACHES

(See also dust schedule immediately following spray schedule.)

1. During winter when trees are dormant. Lubricating oil emulsion 3% (Note 1); or lime-sulphur 12½ gal., water to make 100 gal., for San Jose and other scale insects, leaf curl. When oil emulsion is used, add 8-8-100 Bordeaux for peach leaf curl in sections where prevalent. Lime-sulphur solution should not be used on peach trees in the South until after 2 or 3 good killing frosts have occurred. Lubricating oil emulsion can be used any time after leaves fall.

2. When 75% of petals (pink part of flower) have fallen. Arsenate of lead 2 lbs., lime water from 6 lbs. unslaked lime, water to make 100 gal., for curculio. If hydrated lime is used instead of unslaked lime, use 8 lbs. to 100 gal. water.

3. When calyces or "shucks" are shedding, or when small peaches are exposed. Usually about 10 days after petals fall. Arsenate of lead 2 lbs., lime water from 6 lbs. unslaked lime, water to make 100 gal., for curculio. If hydrated lime is used instead of unslaked lime, use 8 lbs. to 100 gal. water.

4. Two weeks after third application, or about 4 weeks after petals have been shed. 16-16-100 self-boiled lime sulphur (no arsenate of lead is used in this application), for scab, brown rot. If for unavoidable reasons the first spray cannot be applied, use arsenate of lead in this application with self-boiled lime-sulphur.

5. Four weeks before each variety is due to ripen. Arsenate of lead 2 lbs., 16-16-100 self-boiled lime-sulphur, for curculio, brown rot, scab. A very important spray for second brood of curculio "worms" and must be applied according to ripening period of each variety. It is, furthermore, the most important application for brown rot control.

PLUMS

(See also dust schedule immediately following spray schedule.)

1. During winter when trees are dormant. Lubricating oil emulsion 3% (Note 1); or lime-sulphur 12½ gal., water to make 100 gal., for San Jose and other scale insects. Lime-sulphur solution should not be used on plum trees in the South until after 2 or 3 good killing frosts have occurred. Lubricating oil emulsion can be used any time after leaves fall.

2. When 75% of petals have fallen. Arsenate of lead 2 lbs., lime water from 6 lbs. unslaked lime, water to make 100 gal., for curculio. If hydrated lime is used instead of unslaked lime, use 8 lbs. to 100 gal. water.

3. When calyces or "shucks" are shedding or when small plums are exposed. Arsenate of lead 2 lbs., lime water from 6 lbs. unslaked lime, water to make 100 gal., for curculio. If hydrated lime is used instead of unslaked lime, use 8 lbs. to 100 gal. water.

4. Two weeks after third application. 16-16-100 self-boiled lime-sulphur, calcium caseinate 1 lb., for brown rot, leaf spot. For all varieties of plums other than Japanese, lime-sulphur concentrate, 3 parts to 100 parts water, should be used instead of self-boiled lime-sulphur.

5. Four weeks before ripening. 16-16-100 self-boiled lime-sulphur, arsenate of lead 2 lbs., calcium caseinate 1 lb., for curculio, brown rot, leaf spot. For all varieties of plums other than Japanese, lime-sulphur concentrate, 3 parts to 100 parts water, should be used instead of self-boiled lime-sulphur.

SOUR CHERRIES

1. **During winter when trees are dormant.** Lubricating oil emulsion 3% (Note 1); or lime-sulphur 12½ gal., water to make 100 gal., for San Jose and other scale insects.

2. **When 75% of petals have fallen.** Arsenate of lead 2 lbs., lime water from 6 lbs. unslaked lime, lime-sulphur 3 gal., water to make 100 gal., for curculio, leaf spot.

3. **Three weeks after shedding of petals.** Arsenate of lead 2 lbs., lime water from 6 lbs. unslaked lime, lime-sulphur 3 gal., water to make 100 gal., for curculio, brown rot, leaf spot.

4. **Immediately after fruit is harvested.** Lime-sulphur 3 gal., water to make 100 gal., for leaf spot.

SWEET CHERRIES

Sweet cherries should receive the same materials as noted for sour varieties, except that for the summer sprays the lime-sulphur concentrate should be used in the proportion of 2 gal. to 100 gal. of water.

APPLES, PEARS AND QUINCES

1. During winter when trees are dormant. Lubricating oil emulsion 3% (Note 1); or lime-sulphur 12½ gal., water to make 100 gal., for San Jose and other scale insects. In localities where aphids are troublesome, this application should be delayed until the green can just be seen in end of blossom buds; if aphids are prevalent, add 1 pt. 40% nicotine sulphate to 100 gal. water.

2. Immediately after cluster buds have opened. Arsenate of lead 2 lbs., lime-sulphur 3 gal., water to make 100 gal., for curculio, tent caterpillar, scab, etc. Add nicotine sulphate if aphids are troublesome. This spray may be omitted on varieties not susceptible to scab.

3. Immediately after petals fall. Arsenate of lead 2 lbs., lime-sulphur 3 gal., water to make 100 gal., for codling moth, curculio, leaf roller, tent caterpillar, scab, etc. This is the most important application for codling moth and the spray should be driven well into calyx end of small apples. Avoid over-spraying.

4. Two to 3 weeks after petals fall. Arsenate of lead 2 lbs., 6-8-100 Bordeaux, for codling moth, leaf roller, scab, leaf spot, blotch, etc.

5. Three weeks after fourth application. Arsenate of lead 2 lbs., 6-8-100 Bordeaux, for codling moth, blotch, bitter and black rots.

6. Two to 3 weeks after fifth application. Arsenate of lead 2 lbs., 8-8-100 Bordeaux, for codling moth, bitter and black rots, blotch.

7. One month before each variety is due to ripen. Arsenate of lead 2 lbs., 8-8-100 Bor-

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New England Schedules

(From preceding page)

3. About July 1. Dry-mix sulphur lime 25 lbs., water to make 100 gal.; or 16-16-100 self-boiled lime-sulphur, for brown rot, leaf spot. Sulphur dust may be used.

4. Two to four weeks after No. 3. Same materials as in No. 3, for leaf spot, brown rot. Should not be used on early ripening varieties as spray stains are likely to show on ripe fruit.

Notes. 1. If European red mite eggs or San Jose scale are present, a special spray of oil emulsion 4 to 5 gal., water to make 100 gal., should be applied when trees are dormant.

2. For European varieties as Bradshaw and Lombard, use lime-sulphur 2 gal., water to make 100 gal., in place of the dry-mix sulphur lime or self-boiled lime-sulphur. No. 1 spray should then be applied in the pre-blossom stage.

GRAPES

1. As buds are opening. Arsenate of lead 3 lbs.,, Bordeaux 8-8-100, for flea beetles, which feed on the opening buds, causing a serious reduction in the crop.

2. When shoots are 8 to 12 in. long. Before flower buds open but after flower clusters are well formed. Same materials as in No. 1, for black rot, downy mildew, anthracnose, flea beetle.

3. Just after blossoms have faded. Same materials as in No. 1, for berry moth, black rot, downy mildew, anthracnose, flea beetle, root worm. Many consider this the most important single spray. If leaf hoppers are numerous, add 1 pt. 40% nicotine sulphate to each 100 gal. of solution.

4. Ten days to 2 weeks after No. 3. Arsenate of lead 3 lbs., 40% nicotine sulphate 1 pt., Bordeaux 8-8-100, for leaf hopper nymphs, black rot, downy mildew, flea beetle, berry moth, anthracnose.

5. Two weeks after No. 4. Bordeaux 8-8-100, for black rot, downy mildew.

Note. If wet weather prevails, additional applications of Bordeaux may be necessary.

PEACHES

1 Dormant spray. In late autumn or early spring before buds begin to swell. Lime-sulphur 7 gal., water to make 100 gal., for peach leaf curl. If San Jose scale is present, use 12 gal. lime-sulphur. If European red mite eggs are present, lime-sulphur may be applied in autumn, and an oil emulsion spray in spring.

2. When blossoms show pink. Dry-mix sulphur lime 25 lbs., water to make 100 gal.; or self-boiled lime-sulphur 16-16-100, for brown rot. Sulphur dust may be used in place of liquid spray.

3. When shucks are falling. Dry-mix sulphur lime 25 lbs., arsenate of lead 3 lbs., water to make 100 gal.; or self-boiled lime-sulphur 16-16-100, arsenate of lead, 3 lbs., for plum curculio, brown rot, peach scab. This is considered by many growers the most important single spray. A dust composed of sulphur 85 parts, arsenate of lead 15 parts, may be used in place of above materials.

4. Ten days or 2 weeks after No. 3. This is for the same insects and diseases as in No. 3 and the same materials should be used.

5. Three or 4 weeks after No. 4. Dry-mix sulphur lime 25 lbs., water to make 100 gal.; or self-boiled lime-sulphur 16-16-100, for brown rot, scab. Sulphur dust may be used for this application. Omit this application on early ripening varieties.

Note. Some growers add 8 lbs. lime to each 100 gal. dry-mix sulphur lime-arsenate of lead solution to reduce arsenical injury.

PEARS

1. Dormant spray. Before psylla eggs are laid. Oil emulsion 4 to 5 gal. (3% actual oil), water to make 100 gal., for scale, adult psylla.

2. Cluster bud spray. As blossom buds are separating in cluster. Lime-sulphur 12 gal., water to make 100 gal., for psylla eggs, scab, San Jose scale.

3. Calyx spray. Just after petals fall. Lime 40 lbs., copper sulphate 2 lbs., arsenate of lead 3 lbs., 40% nicotine sulphate 1 pt., water to make, 100 gal.; or dry-mix sulphur lime 25 lbs., arsenate of lead 3 lbs., 40% nicotine sulphate 1 pt., water to make 100 gal., for codling moth, scab, psylla, curculio, leaf spot. Sulphur-arsenate of lead dust 85-15 may be used in place of above materials.

4. Three to 5 weeks after calyx spray. Same materials as in calyx spray, for sooty fungus, scab, psylla.

Note. Emergency sprays for psylla are necessary when the nymphs become abundant. This may occur at almost any time during the growing season. Use same materials as for the calyx spray.

Arsenate of lead. Directions in above schedules are based upon powdered arsenate of lead; if paste form is used, double the amount.

Lime-sulphur. Directions in these schedules are based upon the use of lime-sulphur concentrate testing 33 degrees Baume.

Oil Emulsion. Directions for the use of oil emulsion are based on the government formulas.

Rocky Mountain States

By L. S. MORRIS
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The Rocky Mountain district is a large one and includes a diversity of conditions. Therefore it is natural that fruit pests in one place should present problems different from those in other localities. The codling moth is perhaps the worst enemy of apples in the leading growing sections of this district, yet there are a number of localities in which it is unnecessary to spray for this pest. This, of course, may not always be true.

Certain of the insect and disease pests listed in the spray schedule are troublesome year after year only in certain sections. This means, then, that each grower should become familiar with the pests which are especially bad in his section and spray accordingly. This leads to the conclusion that a definite yearly spray program for the Rocky Mountain district is not as practical as a consideration of the individual pests. However, it is recommended that wherever pests are virulent and persistent enough to warrant the application of a certain number of sprays yearly, such a program be carried out.

Fruit growers should be on the alert and study their individual problems, because the degree of attack of pests may vary greatly from year to year.

APPLES

Codling moth. Arsenate of lead 3 lbs., water 100 gal. (1) Immediately after petals fall. (2) About two to three weeks after first spray. (3) About two weeks after second spray. (4) About July 20. (5) About August 10. (6) About August 25. In many sections two sprays are sufficient. Keep in touch with crop pest inspector as to time of hatching.

Scale insects. Lime-sulphur 12 gal., water to make 100 gal. or miscible oil 6 gal., water to make 100 gal. In spring before buds open and in autumn after leaves fall. If insects are bad in summer, they may be partly checked by light kerosene emulsion.

Fruit tree leaf roller. For eggs, miscible oil 8 gal., water to make 100 gal., just before buds open. For larvae, arsenate of lead 6 lbs., water 100 gal., when pink of buds shows or after most of petals have fallen.

Green apple aphis. Prune infected shoots and spray with nicotine sulphate ¾ pt., laundry soap 5 lbs., water to make 100 gal. Spraying should be done before leaves curl, pruning

Apple curculio. Destroy hibernating places. Cultivate soil. Spray with arsenate of lead 3 lbs., water 100 gal., when most of petals have fallen. Where curculio and codling moth appear together, one spray will control both.

Apple leaf hopper. Nicotine sulphate 1 pt., laundry soap 5 lbs., water to make 100 gal. Spray early before fringed stage appears. The nozzle should be turned on the under side of leaves as the insects stay there.

Bud moth. Arsenate of lead 3 lbs., water 100 gal. When buds are bursting, but before petals unfold. This insect is confined to the northern end of the district.

Leaf blister mite. Lime-sulphur 9 gal., water to make 100 gal., or miscible oil 6½ gal., water to make 100 gal. Apply during dormant season until buds open. When both leaf blister mite and San Jose scale are present, use lime-sulphur.

Round headed and flat headed apple tree borers. Keep trees vigorous. Prevent egg laying on trunks with naphthalene repellent. Carbon disulphide may be effective by injecting into hole and plugging up.

Fire blight. Same as for pears.

Blue mold. Avoid bruising and wounding apples. Do not pile apples in storage. (Keep storage temperature low, 30° to 33°.) Blue mold is a storage disease and does much damage under improper conditions.

Apple scab. Lime-sulphur 2½ gal., water to make 100 gal. Just before buds open. This disease is not very troublesome in the dry climate of the Rocky Mountain region.

Black rot. Cut out infected branches. Spray with 8-8-100 Bordeaux (1) in middle of July, and (2) about 2 weeks later.

PEARS

Pear or cherry slug. Arsenate of lead 3 lbs., water 100 gal., or nicotine sulphate 1 pt., water 100 gal. When insects appear.

Leaf blister mite. Same as for apples.

Codling moth. Same as for apples.

San Jose scale. Same as for apples.

Fire blight (pear blight). Prune out infected branches during winter months, making cuts well below darkened area. Sterilize tools and wounds with mercuric cyanide and mercuric chloride, 1 part each to 500 parts water. Avoid rapid growth by withholding irrigation water, frequent cultivation and too much fertilizer. Zinc chloride solutions are being tried on new cankers but as yet cannot be recommended for general practice.

PEACHES

Peach tree borer. Apply P. D. B. as follows: 1 to 2 year old trees ¼ oz.; 3-year-old trees ½ oz.; 4-year-old trees ¾ oz.; 5-year-old trees and over 1 oz. Apply in early September. P. D. B. should be placed in trench around tree, 1 in. deep and 2 or 3 in. from tree.

Peach twig borer. Lime-sulphur 10 gal., arsenate of lead 3 lbs., water to make 100 gal. Apply at pink bud stage. Trees lacking vigor are more subject to attacks of this insect; therefore, keep trees vigorous.

Green peach aphis. Same as for apple aphis.

Black peach aphis. Nicotine sulphate 1 pt., fish-oil soap 5 lbs., water 100 gal. Apply when insects appear. This insect does considerable damage to the roots. Tobacco dust is effective on moist soil.

Peach blight (fruit spot). Prune out cankers. Spray with lime-sulphur 12 gal., water to make 100 gal., when buds begin to burst in spring. Use 12-12-100 Bordeaux, or lime-sulphur 2 gal., water to make 100 gal., as soon as crop is harvested. This disease is prevalent in a few places only.

Peach leaf curl. Lime-sulphur 12 gal., water to make 100 gal. Before buds open in spring. The twig borer or peach blight spray will control leaf curl.

Scab. Self-boiled lime-sulphur 16-16-100. (1) Four weeks after petals fall. (2) If necessary, 3 or 4 weeks later.

CHERRIES

Cherry or pear slug. Same as for pear; however, in the case of cherries, arsenate of lead should not be applied until after harvest.

Black cherry aphis. Nicotine sulphate 1 pt., fish-oil soap 5 lbs., water 100 gal. When insects appear.

Shot hole disease (leaf blight). Lime-sulphur 2 gal., water to make 100 gal. After fruit has set. This disease is not serious in the Rocky Mountain district.

PLUMS

Pear or cherry slug. Same as for pear. Plums are practically free from pests in this district.

APRICOTS

Peach twig borer. Same as for peach.

STRAWBERRIES

Strawberry leaf roller. Arsenate of lead 3 lbs., water to make 100 gal. When adult moths appear in spring, generally soon after growth starts. If pest is very troublesome, cut vines and burn after harvest.

Strawberry crown girdler. Rotate crops. Plow up patch when badly infested, after crop is harvested. If insects are not numerous, the patch may be left 3 or 4 years.

Strawberry root aphis. Scatter straw over plants in early spring and burn. Plow up old infested patches. Proper rotation of crops will keep this insect fairly well in check.

White grubs. Proper crop rotation. If grubs are bad, strawberries should not follow sod.

Chlorosis (yellow leaves). Plant in soil that does not cause leaves to turn yellow.

GRAPES

Grapevine leaf hopper. Nicotine sulphate 3 pts., soap 2 lbs., water to make 100 gal. Early spring before nymphs develop wings.

Powdery mildew. See under pests that feed promiscuously.

Downy mildew. Spray with 10-10-100 Bordeaux, or dust with sulphur. Just before blossom buds open.

Crown gall. Prune out infected branches during dormant season. Plant resistant varieties. If vines are badly infected remove and burn. This disease attacks chiefly the European varieties.

Dead arm. Prune out infected branches during growing season when effects of disease can be observed. If badly infected, remove vines. Take cuttings from disease-free vineyards. In pruning, cuts should be made some distance below infected area. If disease becomes bad, spread may be checked with Bordeaux.

Phylloxera. Graft European varieties on resistant American stocks.

PESTS THAT FEED PROMISCUOUSLY

Buffalo tree hopper. Practice clean cultivation. Burn pruned wood in early spring. This insect does damage to fruit trees by making punctures in which to lay eggs.

Woolly aphis (plant lice). Nicotine sulphate 1 pt., water 100 gal., or 15% kerosene emulsion. Apply when aphids appear in spring and before leaves curl. In some cases, it may be well to prune out infected shoots after leaves curl. (Kerosene emulsion is prepared by shaving ½ lb. laundry soap in 1 gal. boiling soft water. When soap is dissolved, remove solution from fire and add 2 gal. kerosene. Agitate violently until kerosene and soap emulsion are thoroughly emulsified. This is the stock solution and it will keep indefinitely if sealed from air. To make a 15% kerosene emulsion, add 1 gal. of stock solution to 3½ gal. water.)

Grasshoppers and crickets. Tear up breeding grounds with disk or springtooth harrow. Scatter arsenic-bran mash in infested fields and around fruit trees. This mash is made by mixing 25 lbs. bran and 1 lb. white arsenic together. Add 2 qts. cheap molasses and enough water to moisten mixture, and stir thoroughly. Material should broadcast easily.

Clover mite. Lime-sulphur 12 gal., water to make 100 gal., or miscible oil according to directions. Apply during dormant season. San Jose scale treatment destroys the eggs of this mite. The mite feeds on clover and various fruit trees.

Red spider. Nicotine sulphate 2 pts., clear cold water 100 gal. This insect is particularly bad when the summer is especially devoid of rainfall.

Tent caterpillar. Prune out and burn tent masses. Spray with arsenate of lead 3 lbs., water 100 gal., in early growing season when caterpillars appear.

San Jose and Putnam's scales. Lime-sulphur 12 gal., water to make 100 gal.

Powdery mildew. Dust with dusting sulphur in summer as disease appears.

Crown gall. Plant only disease-free stock. Destroy infected stock. Plant only inspected nursery stock.

Arsenate of lead. The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-sulphur. The directions in these schedules are based upon the use of lime-sulphur concentrate testing 32 degrees Baume.

Schedules for the Southeast

(*From page seventeen*)

deaux, for codling moth, bitter rot. If bitter rot is severe, apply Bordeaux between sixth and seventh applications at 2 to 3-week intervals.

Note. Summer apples usually need only the first, second, third and fourth applications of the above spray program; however, the latest ripening summer varieties may need the fifth and sixth.

Pears and quinces usually require only applications 1, 3, 4 and 6, and Bordeaux mixture may be used in place of lime-sulphur on these fruits.

GRAPES

1. During winter when vines are dormant. Lubricating oil emulsion 3% (Note 1); or lime-sulphur 12½ gal., water to make 100 gal., for scale insects.

2. Just before blossoms open. Arsenate of lead 3 lbs., 8-6-100 Bordeaux, for flea beetles, rose chafers, anthracnose, black rot, mildew.

3. After blossoms fall. Arsenate of lead 3 lbs., 8-6-100 Bordeaux, for flea beetles, rose chafers, grape leaf folders, anthracnose, black rot, mildew.

4. Two weeks later. Arsenate of lead 3 lbs., nicotine sulphate ½ pt., calcium caseinate 1 lb., 8-6-100 Bordeaux, for leaf hoppers, aphids, leaf folders, fungous diseases.

5. Two weeks before fruit is due to ripen. Neutral copper sulphate or basic acetate of copper 2 lbs., calcium caseinate 1 lb., water 100 gal., for black rot, mildew.

BLACKBERRIES

1. During late winter just before growth starts. Lime-sulphur 12½ gal., water to make 100 gal., for scale insects, anthracnose.

2. When new shoots are 6 in. high. Lime-sulphur 2½ gal., water to make 100 gal., for anthracnose. Add arsenate of lead 2 lbs. to 100 gal. water if chewing insects are troublesome.

3. When new shoots are 10 in. high. Lime-sulphur 2½ gal., water to make 100 gal., for anthracnose. Add arsenate of lead 2 lbs. to 100 gal. water if chewing insects are troublesome.

4. Just before blooms open. Lime-sulphur 2½ gal., water to make 100 gal., for anthracnose. Add arsenate of lead 2 lbs. to 100 gal. water if chewing insects are troublesome.

STRAWBERRIES

1. Just before blossoms open. Bordeaux 8-8-100 for leaf spot.

2. After blossoms open. Bordeaux 8-8-100, for leaf spot. Add 2 lbs. arsenate of lead to 100 gal. of spray if leaf rollers or flea beetles are present.

3. Two weeks later. Bordeaux 8-8-100, for leaf spot. Add 2 lbs. arsenate of lead to 100 gal. of spray if leaf rollers or flea beetles are present.

Dusting Schedule for the Southeast

PEACHES

(See also spraying schedule immediately preceding.)

1. Liquid only recommended. See above.

2. When 75% of petals (pink part of flower) have fallen. Arsenate of lead 5%, lime 95%, for curculio. It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.

3. When calyces or "shucks" are shedding or when small peaches are exposed. Usually about 10 days after falling of petals. Arsenate of lead 5%, lime 95%, for curculio. It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.

4. Two weeks after the third application, or about 4 weeks after petals have been shed. Sulphur 80%, arsenate of lead 5%, lime 15%, for scab, brown rot.

5. Four weeks before each variety is due to ripen. Sulphur 80%, arsenate of lead 5%, lime 15%, for curculio, brown rot, scab.

PLUMS

(See also spraying schedule immediately preceding.)

1. Liquid only recommended. See above.

2. When 75% of petals have fallen. Arsenate of lead 5%, lime 95%, for curculio. It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.

3. When calyces or "shucks" are shedding or when small plums are exposed. Arsenate of lead 5%, lime 95%, for curculio. It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.

4. Two weeks after third application. Sulphur 80%, arsenate of lead 5%, lime 15%, for scab, brown rot.

5. Four weeks before ripening. Sulphur 80%, arsenate of lead 5%, lime 15%, for curculio, brown rot, scab.

Note 1. The stock lubricating oil emulsion usually contains 66⅔% of oil. Add 4½ gal. of this stock emulsion to 95½ gal. water to make a 3% emulsion.

Arsenate of Lead. The recommendations for arsenate of lead are based on the powdered form; if the paste form is used, double the amount.

Lime-Sulphur. The recommendations for lime-sulphur are based on the use of concentrate testing 32 degrees Baume.

Recommendations for disease control in above schedules furnished by the Office of Fruit Disease Investigations, Bureau of Plant Industry, United States Department of Agriculture.

The Shenandoah-Cumberland Schedule

The apple spray schedule given below was prepared jointly by representatives of the Agricultural Experiment Stations and Extension Departments of the states of Virginia, West Virginia, Maryland, Ohio and Pennsylvania. The apple schedule was sent to us by Prof. L. M. Peairs, entomologist of West Virginia Agricultural Experiment Station.

The spray schedules for the other fruits were prepared by the Departments of Horticulture, Plant Pathology and Entomology of Virginia Polytechnic Institute, and were furnished to us by Prof. F. A. Motz, extension horticulturist.

APPLES

Dormant. Applied only when scale is unusually abundant, during open weather any time in dormant season. Standard proprietary oils, or 4½ gal. engine oil emulsion, water to make 100 gal., for scale insects, red mite.

1. **Delayed dormant.** When buds first show green color. Standard proprietary oils, or 4½ gal. engine oil emulsion, water to make 100 gal., for red mites. Lime-sulphur 12½ gal., water to make 100 gal., or dry lime-sulphur 30 lbs., water 100 gal., for aphis, scale. For aphis, add 1 pt. nicotine.

2. **Cluster bud.** When buds in blossom cluster have separated. Lime-sulphur 10 qts., arsenate of lead 3 lbs., water to make 100 gal., or dry lime-sulphur 7 lbs., arsenate of lead 3 lbs., water 100 gal., for scab, mildew, leaf spot or frog-eye, curculio, bud moth and other chewing insects.

3. **Petal fall.** When most of petals have fallen. Lime-sulphur 10 qts., arsenate of lead 3 lbs., water to make 100 gal., or dry lime-sulphur 7 lbs., arsenate of lead 3 lbs., water 100 gal., for scab, mildew, leaf spot, codling moth, curculio, leaf roller, miscellaneous foliage eaters. If red bug is present, add 1 pt. nicotine to spray.

4. **Three weeks.** About 3 weeks after petal fall spray. Lime-sulphur 10 qts., arsenate of lead 3 lbs., water to make 100 gal., or dry lime-sulphur 6 lbs., arsenate of lead 3 lbs., water 100 gal., or 4-8-100 Bordeaux, arsenate of lead 3 lbs., for scab, frog-eye, mildew, blotch, curculio, codling moth.

5. **Five weeks.** About five weeks after petal fall. Lime-sulphur 10 qts., arsenate of lead 3 lbs., water to make 100 gal., or dry lime-sulphur 6 lbs., arsenate of lead 3 lbs., water 100 gal., or 4-8-100 Bordeaux, arsenate of lead 3 lbs., for blotch, phoma spot, bitter rot, codling moth and other chewing insects.

6. **Seven weeks.** About 7 weeks after petal fall. Lime-sulphur 10 qts., arsenate of lead 3 lbs., water to make 100 gal., or dry lime-sulphur 6 lbs., arsenate of lead 3 lbs., water 100 gal., or 4-8-100 Bordeaux, arsenate of lead 3 lbs., for blotch, phoma spot, bitter rot, codling moth and other chewing insects.

Supplementary sprays. Sprays to control unusual outbreaks of insects or diseases may be needed in addition to the regular schedule. These are usually announced through the local spray service or similar agency.

Note. Since the late summer spray for second brood codling moth is now usually omitted, it is necessary to apply the earlier sprays with extreme thoroughness.

PEACHES

It is a comparatively easy matter to produce a high percentage of clean peaches. The new dry-mix sulphur-lime spray is particularly effective and easy to handle. An important consideration in peach spraying is the advisability of using rods producing a fine, misty spray and not guns with high pressure behind them. Guns producing a fine mist are advisable only in hands of careful spraymen. Defoliation of the trees and undersized fruit result from the use of too much pressure and coarse spray particles. Following is the best spray schedule known for peaches in Virginia.

1. **Dormant season.** (Before buds have commenced to swell.) February or early March. Lime-sulphur 12 gal., water to make 100 gal., for scale, leaf curl.

2. **Immediately after petals drop.** Arsenate of lead 2 lbs., freshly slaked lime 6 lbs., water 100 gal., for curculio.

3. **One week after No. 2.** Arsenate of lead 2 lbs., freshly slaked lime 6 lbs., water 100 gal., for curculio.

4. **Three weeks after No. 3.** Arsenate of lead 2 lbs., self-boiled lime-sulphur or dry mix 100 gal., for curculio, scab.

5. **One month before fruit ripens.** Self-boiled lime-sulphur or dry-mix, for scab, brown rot.

6. **For late varieties only.** Three weeks after No. 5. Self-boiled lime-sulphur or dry-mix, for brown rot.

In the northern part of Virginia and in orchards which are damaged from early infection of brown rot, resulting in blighting of the blossoms and drying up and dropping of small fruit, apply same materials as in spray No. 4 when pink begins to show in the bud. Early infection of brown rot is not prevalent generally over the state, but it occurs in parts of northern Virginia, particularly in Loudoun county. Unless blossom blight has been prevalent, follow the schedule as recommended above. No. 1 must be applied while trees are absolutely dormant and before bud scales begin to separate, if leaf curl is to be controlled, and the pink spray must go on before the petal spray.

If **rose chafer** should become serious, spray with arsenate of lead 8 lbs., water 100 gal., to which 2 gal. molasses are added. Application should be made when bugs appear.

Caution: This spray should not be used unless absolutely necessary, as severe burning may follow.

(*To page 22*)

Protect

FRU

Dow Dry Lime Sulphur

(Endorsed by Experiment Stations)

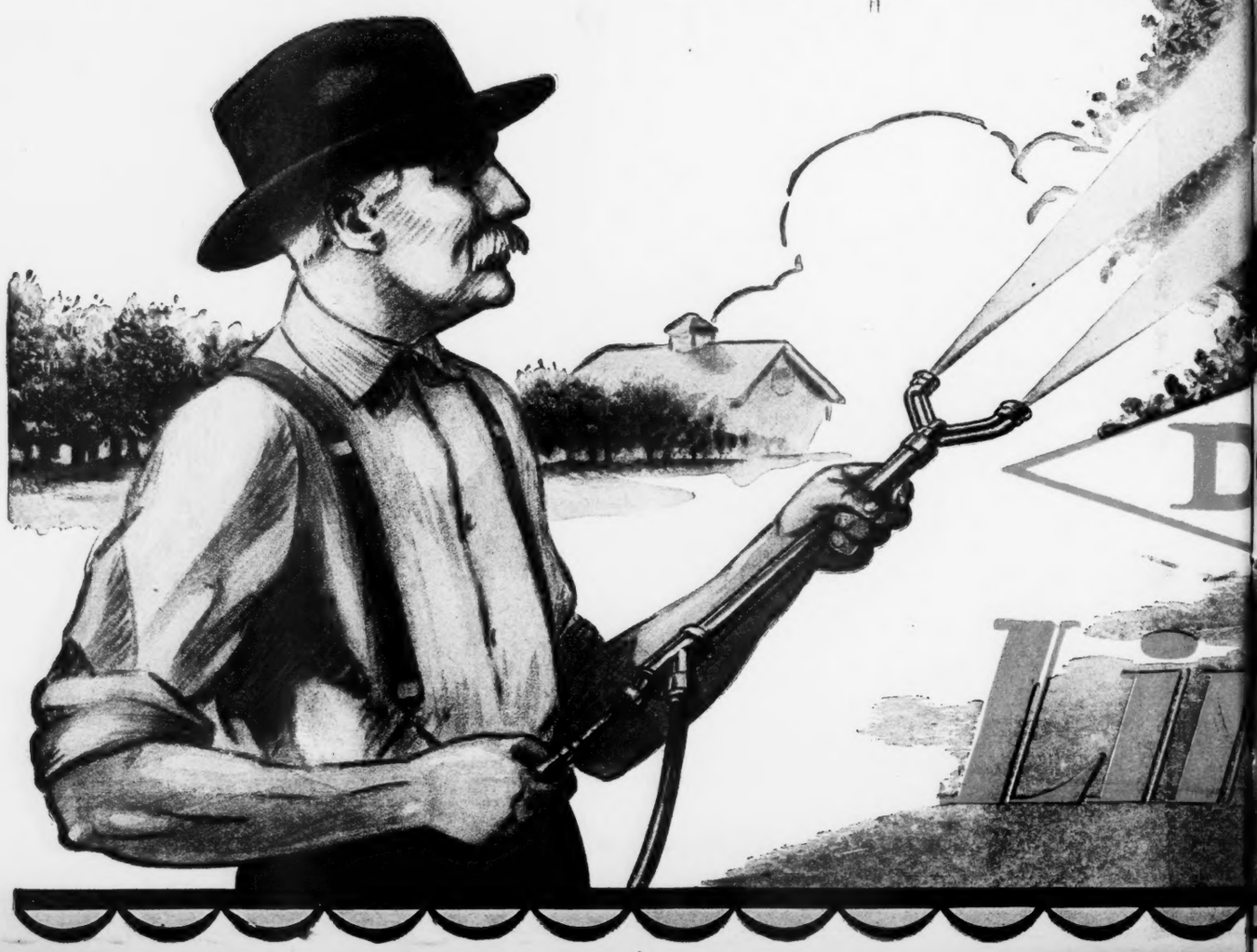
This finely divided, bright yellow powder is the result of evaporating a chemically correct, concentrated, Lime Sulphur Solution, under the supervision of trained Dow chemists.

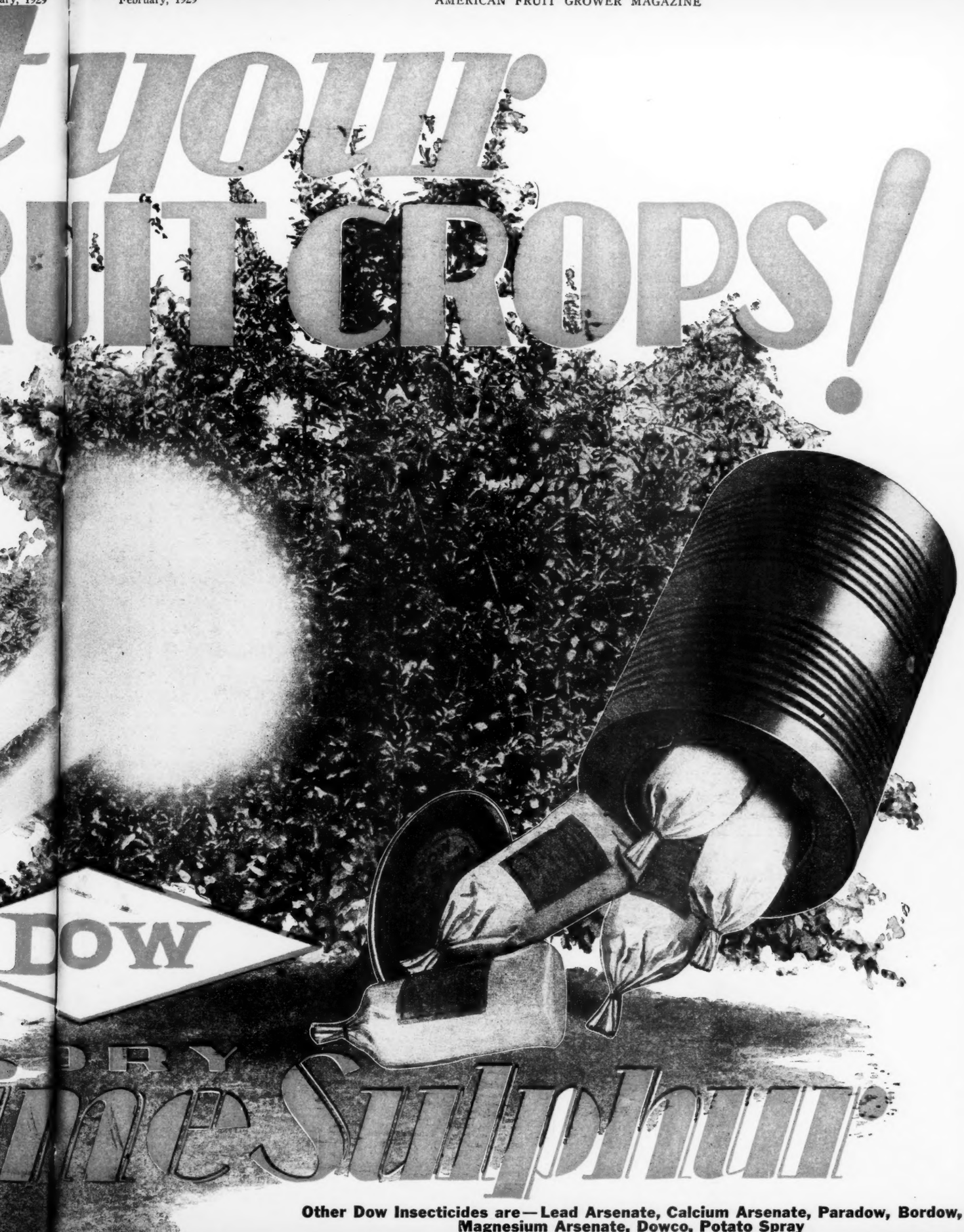
Especially effective in the control of scale insects, blister mite, scab, brown rot, peach leaf curl, etc., Dow Dry Lime Sulphur has come to be a real necessity to keep trees healthy and to deliver smooth, high grade, marketable fruit.

Made under special Dow Processes, Dow Dry Lime Sulphur has for years been the favorite of many of the largest fruit growers in America. Kept at full strength in sealed containers with the highest possible percentage of active ingredients, it serves every purpose for which Lime Sulphur Solution is used.

Just be sure to insist on Genuine Dry Lime Sulphur identified by the Dow Diamond Trade Mark. It is your greatest assurance of satisfaction. Write for literature.

THE DOW CHEMICAL COMPANY, *Midland, Michigan*





Other Dow Insecticides are—Lead Arsenate, Calcium Arsenate, Paradow, Bordow, Magnesium Arsenate, Dowco, Potato Spray

The Michigan Spray Schedule

By W. C. DUTTON
Michigan State College

APPLES

1. Dormant. When buds swell, before green tips appear. Oil emulsion (3% oil), or miscible oil according to manufacturers' directions, for red mite. Oil emulsion (8% oil), for leaf roller. Lime-sulphur 12½ gal., water to make 100 gal., or miscible oil as directed, or 2% to 3% oil emulsion, for scale insects. Treatment for red mites will control scale. Treatment for leaf-roller will control mites and scale insects.

2. Delayed dormant. When green tips on blossom buds are ½ in. long. Lime-sulphur 2½ gal., nicotine sulphate 1 pt., water to make 100 gal., for aphids, scab, bud moth. Increase lime-sulphur to 12½ gal. if scale is to be controlled at this time. Spray very thoroughly. Use 3 lbs. lead arsenate if bud moth is present.

2a. Pre-pink. About midway between delayed dormant and when buds begin to separate in clusters. Lime-sulphur 2½ gal., water to make 100 gal., on all scab susceptible varieties and on all varieties in seasons when growth is slow and conditions are favorable for scab. This is the late limit for aphid control and 1 pt. nicotine sulphate should be added if it was not used in the delayed dormant.

3. Pink or cluster. As soon as possible after buds separate in cluster. Lime-sulphur 2½ gal., arsenate of lead 3 lbs., water to make 100 gal., for scab, fruit worm, leaf roller and other chewing insects. If red bug is present, add 1 pt. nicotine sulphate.

4. Calyx. When most of petals have fallen. Lime-sulphur, 2½ gal., arsenate of lead 3 lbs., water to make 100 gal., for scab, codling moth, curculio, fruit worm. If red bug is present, add 1 pt. nicotine sulphate.

5. Ten-days or 2-weeks. Should be completed in 2 weeks after calyx spray. Lime-sulphur 2½ gal., arsenate of lead 3 lbs., water to make 100 gal., for scab, codling moth, lesser fruit worm and other chewing insects.

5a. Twenty-one day. Complete about 21 days after petal-fall. Use only in orchards where previous applications were not sufficient to control codling moth. Lead arsenate 3 lbs., in 100 gal. water. Repeat if necessary in 10 days or 2 weeks. Add 2 gal. lime-sulphur if scab is prevalent.

6. Second-brood. At time recommended by experiment station entomologist. Lime-sulphur 2 to 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for codling moth, scab.

PEARS

1. Dormant. In early spring when weather is favorable for spraying and before psylla eggs are laid. Oil emulsion 3%, made from a heavy lubricating oil, or miscible oil as directed by manufacturers, for psylla and scale insects.

1a. Delayed dormant. After buds can be seen in cluster but complete before they separate. Lime-sulphur 2½ gal., water to make 100 gal.; or 3-8-100 Bordeaux. Primarily for control of scab and should be used in all parts of state on Flemish Beauty or other very susceptible varieties and on any susceptible variety where scab is generally prevalent. Use 10 gal. lime-sulphur if blister-mite is prevalent.

2. Pink or cluster. When buds have separated in clusters. Bordeaux 3-8-100 for pear scab. Employ this treatment only on Flemish or in districts where scab is generally prevalent.

3. Calyx. As soon as petals have dropped. Bordeaux 2-8-100, arsenate of lead 3 lbs., for scab, codling moth. Omit Bordeaux where scab is not prevalent.

4. Two-weeks. Two weeks after petals have fallen. Bordeaux 2-8-100, arsenate of lead 3 lbs., for scab, codling moth.

5. Second brood. About first of August. Apply at same time as recommended each year for apples, but spray only winter varieties. Excessive arsenical residue may result if used on Bartlett, Clapp, Howell and other varieties of similar season.

Summer control of Psylla. If pear psylla develops during summer, good results may be expected from the use of a 2% spray of a safe "summer oil" (white oil emulsion). Apply in late June or July or when psylla appears. This treatment not usually effective immediately after application but results are usually evident in 2 or 3 weeks.

SPRAY AND DUST SCHEDULE FOR PEACHES

1. Dormant. In early spring before buds begin to swell. Lime-sulphur 12½ gal., water to make 100 gal., for leaf curl, scale. Reduce lime-sulphur to 5 gal. if leaf curl only is to be controlled.

2. After blossoms have dropped and most of "shucks" have fallen. Dust with lead arsenate-hydrated lime dust (5% arsenate of lead); or spray with arsenate of lead 2 lbs., lime 8 to 10 lbs., water 100 gal., for curculio.

3. Two weeks after "shucks" have fallen. Dust with 80-5-15 sulphur-lead-lime dust; or spray with dry-mix sulphur-lime 25 lbs., arsenate of lead 2 lbs., fresh hydrated lime 8 lbs., water to make 100 gal., for curculio, brown rot, scab. If wettable sulphur is used, add 16 lbs. hydrated lime. Extra applications without lead arsenate may be necessary for scab control in some orchards between applications 3 and 4.

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Shenandoah-Cumberland Schedule

(*From Page Nineteen*)

PLUMS

1. Dormant season. Lime-sulphur 12 gal., water to make 100 gal., for scale and general cleanup.

2. As soon as petals fall. Lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal., for curculio, leaf spot.

3. One week after No. 2. Lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal., for curculio, leaf spot.

4. Three weeks after No. 3. Lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal., for curculio, leaf spot.

5. One month before fruit ripens. Self-boiled lime-sulphur, for brown rot and other fungous diseases.

CHERRIES

1. Dormant season. Lime-sulphur 12 gal., water to make 100 gal., for scale.

2. Immediately after petals fall. For sour cherries, lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal.; for sweet cherries, lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for leaf spot, curculio.

3. One week after No. 2. For sour cherries, lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal.; for sweet cherries, lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for leaf spot, curculio.

4. Three weeks after No. 3. For sour cherries, lime-sulphur 3 gal., arsenate of lead 2 lbs., water to make 100 gal.; for sweet cherries, lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for leaf spot, curculio, brown rot.

5. Immediately after fruit is harvested. For sour cherries, lime-sulphur 3 gal., water to make 100 gal.; for sweet cherries, lime-sulphur 2½ gal., water to make 100 gal., for leaf spot.

If rose bug should become serious, apply same treatment as recommended for peaches.

GRAPES

1. Dormant season. Lime-sulphur 12 gal., water to make 100 gal., for scale and general cleanup.

2. When second or third leaf shows. Bordeaux 8-10-100, for anthracnose, bitter rot, black rot, mildew.

3. Before blossoms open. Bordeaux 8-10-100, for anthracnose, bitter rot, black rot, mildew.

4. After blossoms fall. Bordeaux 8-10-100 for anthracnose, bitter rot, black rot, mildew.

5. Ten to 14 days later. Bordeaux 8-10-100, for anthracnose, bitter rot, black rot, mildew.

Thereafter at 2-week intervals until within 2 weeks of harvest time. Bordeaux 8-10-100, for anthracnose, bitter rot, black rot, mildew.

Arsenate of lead 4 lbs. should be combined with 100 gal. Bordeaux if chewing insects make an appearance.

Burgundy mixture, made according to the following formula, may be substituted for Bordeaux in the last spray in order to prevent discoloring of fruit: Caustic soda 10 lbs., copper sulphate 8 lbs., water 100 gal. Prepare and apply same as Bordeaux.

RASPBERRIES AND BLACKBERRIES

Anthracnose causes cankers on canes of raspberry and blackberry. It is the most important disease of bush fruits in Virginia and can be effectively controlled by the application of 2 lime-sulphur sprays according to the following schedule. The addition of a casein spreader at the rate of 1 lb. to 100 gal. of spray material is necessary to secure control.

1. In spring just after growth begins, but not after leaves have reached ½ in. in length. Lime-sulphur 11 gal., water to make 100 gal., for anthracnose.

2. One week before bloom. Lime-sulphur 2 gal., water to make 100 gal., for anthracnose.

STRAWBERRIES

1. When growth begins. Bordeaux 8-10-100, for leaf spot.

2. Before blossoming. Bordeaux 8-10-100, for leaf spot.

3. Just after blossoming. Bordeaux 8-10-100, for leaf spot.

4. After leaves have been mowed and burned. Arsenate of lead 2 lbs., 8-10-100 Bordeaux, for leaf spot, flea beetle.

Should **leaf roller** appear, or if it has been prevalent, add lead arsenate at rate recommended in No. 4 spray in each application.

Arsenate of lead. The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-sulphur. The directions in these schedules are based upon the use of lime-sulphur concentrate testing 32 degrees Baume.

Oil emulsion. The engine oil emulsion recommended in the apple schedule is that made according to Missouri formula No. 2. In making the stock solution according to this formula, use engine oil 2 gal., water 1 gal., calcium caseinate ¼ lb. First thin the caseinate with water, working it into a paste and adding the water gradually. Then add the oil. Agitate the material vigorously by pumping it through a hand sprayer until it is thoroughly emulsified. The resulting material is called the stock solution and should be diluted as indicated.

Self-boiled lime-sulphur. For making 100 gal. self-boiled lime-sulphur, use 16 lbs. fresh lump lime, 16 lbs. ground sulphur, water to make 100 gal. Use only the best grade of lime. Place lime in a barrel or vat and add a bucket of water to start slaking. When slaking is well started, sift in the sulphur and add more water gradually. Stir the lime and sulphur vigorously to prevent caking. Add water as needed to prevent drying or burning, but do not flush the mixture and cool it unnecessarily. When slaking is practically finished, wash the mixture immediately through a strainer to eliminate lumps. Add sufficient water to make 100 gal. Keep material thoroughly agitated and apply in freshest condition possible.

Dry-mix sulphur-lime. Dry-mix is rapidly replacing self-boiled lime-sulphur as a spray for peaches. The advantage of using this new spray material lies in the fact that it has better sticking qualities, gives better control of diseases, and is cheaper and easier to prepare. Dry-mix is made of 16 lbs. finely powdered dusting sulphur, 8 lbs. hydrated lime, 1 lb. calcium caseinate. These amounts are used in 100 gal. water. The materials can be mixed dry during the winter and stored for use. The mixture is prepared in the spray tank as follows: Fill the tank half full of water; then, with agitator running, add the dry materials slowly, directing the spray nozzle upon the material until it has disappeared in the water.

(From top of preceding page)

4. One month before fruit ripens. Dust with sulphur dust; or spray with dry-mix or a wettable sulphur, for brown rot and scab.

5. One week to 10 days before harvest. Dust with sulphur dust; or spray with a wettable sulphur, for brown rot. Especially important on early varieties and any other varieties subject to rot.

GRAPES

1. When shoots are 8 to 10 in. long. Bordeaux 8-8-100, for black rot, downy mildew. This spray often omitted without bad results but in years of heavy rot development, applications 1 and 2 are often the most critical ones of all for rot control.

2. Just before blooming period. Arsenate of lead 3 lbs. in 8-8-100 Bordeaux, for black rot, berry moth, downy mildew. If rose chafer is prevalent, add more arsenate and 1 gal. cheap molasses. Critical application for control of berry moth.

3. Just as blossoms are falling. Arsenate of lead 3 lbs. in 8-8-100 Bordeaux, for black rot, berry moth, downy mildew.

4. About 2 weeks after No. 3. Arsenate of lead 2 lbs. in 8-8-100 Bordeaux, for black rot, berry moth, mildew. Necessity for spray at this time will depend on conditions and on prevalence of insects and diseases.

5. Just before berries touch in clusters. Arsenate of lead 2 lbs. or more, resin fish-oil soap 2 lbs. in 8-8-100 Bordeaux, for black rot, berry moth, mildew, and leaf hoppers. Spray upward with short rod and angle nozzle. Add 1 pt. nicotine sulphate in 100 gal. of spray if leaf hoppers are ready. Otherwise make separate spray, using 1 pt. nicotine sulphate, resin fish-oil soap 2 lbs., water 100 gal. This application very important for berry moth. If hoppers are not present, omit nicotine. Hopper treatment may usually be made at this time but should be delayed if necessary until oldest nymphs get wings. Do not delay berry moth treatment later than indicated.

CHERRIES AND PLUMS

1. Dormant. Just before growth starts. Lime-sulphur 12½ gal., water to make 100 gal., for scale insects. Use an oil spray if mites are prevalent.

2. Petal-fall. Just after petals have dropped. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for leaf spot, slug, brown rot, curculio. (For sweet cherries never use more than 2 gal. lime-sulphur.) The concentration of lime-sulphur may be increased to 3 gal. in this and succeeding sprays on sour cherries if leaf spot becomes serious.

3. Two weeks. Should be complete within 2 weeks after petal-fall. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for leaf spot, brown rot, curculio, slugs.

4. Four weeks after petal-fall. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal., for leaf spot, cherry maggot, curculio, slug, brown rot. This and No. 5 are important for control of cherry maggot or fruit fly.

5. When fruit flies emerge. Arsenate of lead 2½ lbs., water 100 gal., for cherry fruit fly or maggot. Apply at time recommended each year by experiment station entomologist. This spray not advisable on cherries which do not go to canning factory. Sulphur dust at this time and later may be valuable in control of rot on cherries which are to remain on trees for late harvest.

6. After harvest. Just after fruit is picked. Lime-sulphur 2½ gal., arsenate of lead 1 lb. to 2 lbs., water to make 100 gal., for leaf spot, slugs. Desirable to prevent late summer defoliation.

Plums. In general, plums are most often injured by leaf spot, brown rot and curculio and require the same type of treatment as cherries. If scale is present, make application No. 1 and follow with Nos. 2 and 3 and one fungicide only about 1 month before harvest. The local prevalence of curculio should determine how many times arsenate of lead should be used. In general, poison in Nos. 2 and 3 is sufficient. Use 2½ gal. lime-sulphur in 100 gal. of spray, except on Japanese plums, for which dry-mix sulphur-lime spray should be used as on peaches. A late application of sulphur dust just before harvest is often very valuable for control of rot.

Cherry Aphids. If black cherry aphid is present, use nicotine sulphate 1 pt., soap 2 to 3 lbs., water 100 gal., just before blossoming. Drench the trees. Repeat during summer if necessary.

CURRANTS AND GOOSEBERRIES

1. Dormant. Before growth starts. Lime-sulphur 12½ gal., water to make 100 gal., for scale insects. Apply only if scale is present.

2. When leaves are ½ to 1 in. in diameter. Arsenate of lead 2 lbs., nicotine sulphate 1 pt., 8-8-100 Bordeaux, for leaf spot, leaf-eating insects, aphids. Very thorough application necessary to insure aphis control.

3. Soon after blooming period. Arsenate of lead 2 lbs., 8-8-100 Bordeaux, for leaf spot, leaf-eating insects. If aphids persist or have not been treated earlier, use nicotine spray or dust.

4. Ten days to 2 weeks after No. 3. Arsenate of lead 2 lbs. in 8-8-100 Bordeaux, for leaf spot, leaf-eating insects.

5. Just after fruit is harvested. Arsenate of lead 2 lbs. in 8-8-100 Bordeaux, for leaf spot, leaf-eating insects. Necessity for this treatment will depend on local conditions and varieties grown.

RASPBERRIES AND DEWBERRIES

Anthracnose. The only common disease of brambles controllable by spraying is anthracnose. It can be greatly reduced, if not entirely eliminated, in new plantings by removing the portion of old cane usually left attached to the tip. This should be cut off at time of planting so no part protrudes above ground. Remove these pieces from the field. If anthracnose is present, spray (1) when buds show green, using lime-sulphur 10 gal., water to make 100 gal. Addition of 1 lb. casein-lime spreader will improve the spray; (2) about 1 week before blossoms open, using Bordeaux 4-8-100. Lime-sulphur used at this time will control the disease but may cause serious injury.

Blackcap raspberries and dewberries usually need spraying every year, but red varieties are seldom affected by the disease but should be sprayed as indicated if anthracnose develops.

The Southwest Schedules

By HAMILTON P. TRAUB

Texas Agricultural Experiment Station

CITRUS FRUITS

1. May and July. Oil emulsion (Note 1), for scale insects. See Report for Substation No. 15, Weslaco, in Ann. Rept. Texas Agr. Expt. Sta. 1928 (1929).

2. When two-thirds of petals have fallen. Lime-sulphur 1½ gal., nicotine sulphate 13 oz., water to make 100 gal., for red spider, thrip, rust mite.

3. When fruit is about 1 in. in diameter. Soda-sulphur 2 gal. (Note 2), oil emulsion 1½ gal. (Note 1), water to make 100 gal., for scale insects, rust mite, red scale.

4. Ten to 14 days after No. 3. Spray with lime-sulphur 1½ gal., water to make 100 gal., or dust with sulphur, for rust mite, red spider.

5. July or August. Spray with lime-sulphur 1½ gal., water to make 100 gal., or dust with sulphur, for scale insects, rust mite, red spider.

PEACHES, PLUMS AND APRICOTS

1. After leaves have fallen and until growth starts in spring. Bordeaux 8-8-100, for peach leaf curl; oil emulsion (Note 1), for San Jose scale. Both peach leaf curl and scale may be controlled with lime-sulphur 11 gal., water to make 100 gal.

2. When two-thirds of shucks are off. Arsenate of lead 4 lbs., 16-16-100 self-boiled lime-sulphur, or arsenate of lead 4 lbs., wettable sulphur 100 gal. (Note 3), for brown rot, curculio, scab, biting insects, leaf spot.

3. Seven to 10 days after No. 2. Arsenate of lead 4 lbs., 16-16-100 self-boiled lime-sulphur, or arsenate of lead 4 lbs., wettable sulphur 100 gal. (Note 3), for brown rot, curculio, scab, leaf spot, biting insects.

4. About 4 weeks before ripening. Self-boiled lime-sulphur, or wettable sulphur (Note 3), for brown rot, scab, leaf spot.

5. October 1 to 15 and March 1 to 15. Paradichlorobenzene in soil (see U. S. Dept. Agr. Bul. No. 1169), for borers.

6. Fall and winter. Dig out borers.

PECANS

1. Dormant season. Oil emulsion (Note 1), for obscure scale.

2. When first larvae are seen after nuts are set. Arsenate of lead 6 lbs., water 100 gal., for nut case bearer. Add 3 lbs. lime if water contains sulphur.

3. After growth starts and during humid weather. Bordeaux 8-8-100, for scab.

4. When first worms appear. Arsenate of lead 4 lbs., water 100 gal., for webb worms.

BLACKBERRIES AND DEWBERRIES

Dig up diseased plants early in spring and destroy them. Wild brambles in neighborhood should be destroyed. For control of orange rust. Plant resistant varieties.

FIGS

As soon as disease appears, usually about July 15. Repeat every month until September 15. Bordeaux 10-10-100, for rust. If growth is unusually rapid, it may be necessary to spray oftener than once a month in order that new growth may be covered with spray material. See Texas Circ. 47, 1927.

DATES

1. When scale appears. Defoliate palm, leave terminal shoots 6 to 12 in.; use gas torch flame, for Parlatoria scale, **Parlatoria Blanchardi.**

2. When scale appears. Defoliate palm, leave terminal shoots 6 to 12 in.; use gas torch flame, for Mariatt scale, **Phoenicoccus mariatti.**

3. When mites appear. Nico-sulphur dust, or cresylic-distillate emulsion, for mites, **Paratetranychus heteronychus.**

4. When insect appears. Nicotine-soap spray, for date bug, **Asarcopus palmarum.**

GRAPES

1. After leaves have fallen and before growth starts in spring. Bordeaux 8-8-100, for black rot, mildew.

2. When leaves are out 4 to 6 in. Arsenate of lead 4 lbs., 8-8-100 Bordeaux, for black rot, mildew, biting insects.

3. Ten days to 2 weeks after No. 2. Nicotine sulphate 1 pt., 8-8-100 Bordeaux, for black rot, mildew, biting insects, sucking insects.

4. Two weeks after No. 3. Bordeaux 8-8-100, for black rot, mildew.

5. Two weeks before harvest if necessary. Bordeaux 8-8-100, for black rot, mildew.

APPLES AND PEARS

1. After leaves have fallen and until growth starts in spring. Lime-sulphur 11 gal., water to make 100 gal.; or oil emulsion (Note 1), for San Jose and other scale insects.

2. When 90% to 100% of petals have fallen; rush to completion. Arsenate of lead 4 lbs., nicotine sulphate 1 pt., water to make 100 gal., for codling moth, plant lice, curculio, biting insects. The most important application for codling moth.

3. Eighteen days after No. 2. Arsenate of lead 4 lbs., 8-8-100 Bordeaux, for codling moth, blotch, curculio, biting insects.

4. Six weeks after No. 3. Arsenate of lead 4 lbs., 8-8-100 Bordeaux, for codling moth, blotch, curculio, biting insects.

5. Three weeks after No. 4. Arsenate of lead 4 lbs., 8-8-100 Bordeaux, for codling moth, blotch, curculio, biting insects.

6. Three weeks after No. 5. Arsenate of lead 4 lbs., 8-8-100 Bordeaux, for codling moth, blotch, curculio, biting insects.

Note 1. Either of the following two formulas for making oil emulsion may be employed in making the above spray mixtures:

Cold Stirred Oil Emulsion Stock Solution

Fish-oil soap (preferably liquid)	8 lbs.
Paraffin oil	2 gal.
Water	1 gal.

The soap should be placed in a receptacle in which the emulsion is to be made. A pint of oil should be added and stirred vigorously until no free oil is visible. This should be continued until the required amount of oil is used and completely emulsified. The water should then be added slowly in the same manner. This stock solution should be diluted with 200 gal. of soft water, or 1 gal. of this stock solution should be used to 50 gal. of soft water.

Boiled Oil Emulsion Stock Solution

Fish-oil soap (1 gal. liquid)	2 lbs.
Paraffin oil	2 gal.
Water	1 gal.

Mix ingredients together and heat to boiling point. Then emulsify by pumping and repumping the mixture into itself. Merely stirring is not sufficient. A hand spray or barrel spray pump will serve the purpose. If solution is too thick at the time it is to be used, bring it to a warm temperature, but do not boil. This amount of stock solution should be diluted with 200 gal. of water.

Note 2. The following directions for making soda-sulphur stock solution are taken from Farmers' Bulletin 933:

"The main value of the soda-sulphur solution consists in the properties which enable it to be used in combination with the oil emulsions. Owing to the superiority of lime-sulphur solution, the use of soda-sulphur solution alone is not advised. It has a distinct place, however, in forming a good combination spray for white flies, scale insects and mites. It is made as follows:

Stock Soda-Sulphur Solution Formula

Flowers of sulphur	30 lbs.
Caustic soda (98%)	20 lbs.
Water	20 gal.

"To remove the lumps from the sulphur, place a wire screen over the barrel and rub the sulphur through with the hands, then slowly add about 3 gal. water and stir so as to form a thin paste. The caustic soda should then be added and the entire mixture stirred vigorously. Some growers add the caustic soda gradually to prevent too vigorous boiling. It is also practicable to dissolve the caustic soda in about 4 gal. of water before it is added to the sulphur. The boiling will be quite violent and it may be necessary to add a gallon or more of water during the process, but whether or not this is necessary can be determined by the operator.

"The main difficulty in making this formula is that too great heat is generated, which liquifies the sulphur before it can be acted on by the caustic. If sediment forms, this has been the cause. To prevent this excessive heat, add more water in the beginning and during the process. After boiling has ceased, add about 16 gal. water.

"For spraying against red spiders and rust mites, use 1 gal. of this stock solution to 40 gal. water. When used with the oil sprays, the strength should be a little weaker than if used alone. When so used, dilute 1 gal. to 50 gal. water. If it is to be used in combination with oil emulsion, it should be added to the tank or barrel of water before the oil emulsion."

To make the soda-sulphur solution combination as given in the spray schedule, add 1½ gal. oil emulsion to 100 gal. of diluted solution.

Note 3. Wettable sulphur is made from 8 lbs. hydrated lime, 16 lbs. superfine sulphur and 1 lb. calcium caseinate to 100 gal. water. The materials can be mixed dry in advance and stored for use. In preparing the spray mixture, proceed as follows: Fill the tank half full of water. Then with agitator running, add the dry material slowly and direct the spray nozzle upon the material until it has disappeared in the water.

Arsenate of Lead. The directions in this schedule are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur. The directions in this schedule are based upon the use of lime-sulphur concentrate testing 32 degrees Baume.

Pacific Northwest Schedules

By LEROY CHILDS, Hood River Experiment Station, and H. P. BARSS, Oregon Agricultural College

On account of the climatic differences existing in the more humid orchard sections west of the Cascade Mountains and the semi-arid and irrigated regions east of this range, the conditions as to pests and diseases are different and require a somewhat different spray program. In general, there are a greater number of diseases and pests to be sprayed for in western Oregon, Washington and British Columbia than in the drier orchard sections of the interior. Hence, the full spray schedule for the section west of the Cascades will be presented and then followed by paragraphs outlining the schedule for other sections.

Schedule 1. For humid sections of Washington, Oregon and British Columbia west of Cascades.

APPLES AND PEARS

1. Dormant spray. As winter buds swell just before opening. Lime-sulphur 12 gal., water to make 100 gal., or miscible oil 8 gal., water to make 100 gal., for San Jose scale, blister mite, spider mite. Use miscible oil according to manufacturers' directions, as green tips emerge when leaf roller is present.

2. Pre-pink spray. When cluster buds open just enough to expose blossom buds. Lime-sulphur 3¼ gal., water to make 100 gal., for scab, powdery mildew. If anthracnose is under good control, use 12-12-100 Bordeaux instead of summer spray. Add ¾ lb. nicotine sulphate to 100 gal. spray when aphids are present.

3. Pink or pre-blossom spray. Just before blossoms open. Lime-sulphur 2½ gal., water to make 100 gal., for scab, mildew. For fruit worms and bud moth, add 3 lbs. lead arsenate to 100 gal. spray.

4. Calyx spray. As last of petals fall. Before apple calyx closes on central fruit in cluster. Lime-sulphur 2½ gal., arsenate of lead 2 lbs., water to make 100 gal. (Footnote 2), for scab, mildew, codling moth on apple, fruit worm on pear. To control moderate leaf roller infestation, use double quantity lead arsenate.

5. Fifteen-day spray. About 15 days after petals fall. Lime-sulphur 2 gal., water to make 100 gal. (Footnote 2), for scab, mildew. Add lead arsenate 2 lbs. to 100 gal. spray for pear slugs.

6. Thirty-day or first cover spray for worms.

Three to 5 weeks after petals fall. Arsenate of lead 2 lbs., water 100 gal., for codling moth. Add wettable sulphur (Footnote 9) for scab and mildew.

7. July spray. July 10 to 25, depending on locality and season. Arsenate of lead 2 lbs., hydrated lime 2 lbs. (Footnote 3), water 100 gal., for codling moth, second generation. For anthracnose canker use 8-8-100 Bordeaux.

8. August spray. August 10 to September 5, depending on season and locality. Arsenate of lead 2 lbs., hydrated lime 2 lbs. (Footnote 3), water 100 gal., for codling moth. May usually be omitted on pear.

PRUNES AND PLUMS

1. Dormant spray. As winter buds are ready to open. Lime-sulphur 12 gal., water to make 100 gal., for San Jose scale, spider mite, twig miner. If scale is absent, use only 8 gal. lime-sulphur, water to make 100 gal.

2. Pre-blossom spray. When buds are white just before opening. Bordeaux 8-8-100 with spreader, or lime-sulphur 3 gal., water to make 100 gal., for brown rot blossom blight. For aphids, use nicotine sulphate ¾ lb. in 100 gal. For bud moth use arsenate of lead 2 lbs., lime 2 lbs., in 100 gal.

3. First fruit spray. As soon as shucks fall. Wettable sulphur (Footnote 9), for leaf spot, brown rot.

4 and 5. About June 1 and July 1. Spray with wettable sulphur (Footnote 9), or dust with sulphur, for leaf spot or brown rot if troublesome.

6. August spray. About a month before harvest. Spray with wettable sulphur (Footnote 9), or dust with sulphur, for brown rot.

PEACHES

1. Leaf curl spray. December or January. Bordeaux 12-12-100, for peach leaf curl.

2. Late dormant spray. Just as first buds are ready to open. Lime-sulphur 12 gal., water to make 100 gal., for peach twig miner, San Jose scale, spider mite. If scale is absent, use 8 gal. lime-sulphur, water to make 100 gal. For bud moth, add arsenate of lead 2 lbs., lime 2 lbs., in 100 gal. spray.

3. First fruit spray. As soon as shucks fall. Wettable sulphur (Footnote 9), for peach blight (fruit spot), mildew, brown rot. If disease condition is bad, repeat at 2 or 3-week intervals.

4. Late summer spray. About 6 weeks before harvest. Spray with wettable sulphur (Footnote 9), or dust with sulphur, for brown rot.

5. Early fall spray. As soon as each variety is picked. Bordeaux 8-8-100, for peach blight, die back. For young trees or trees with no crop, apply in August.

CHERRIES

San Jose scale. Same as No. 1 in prune schedule.

Aphids. Use nicotine sulphate 1 lb. to 100 gal. with pre-blossom spray (same as No. 2 for prune). Use tanglefoot bands on trees to prevent reinfestation of aphids by ants.

Syneta beetle. Use lead arsenate 4 lbs., lime 2 lbs. in 100 gal. water. The first year Syneta control is applied, put on this spray just before and just after blossoming; in succeeding years before bloom only.

Cherry fruit maggot. Use the following sweetened poison spray for adult flies: Lead arsenate ½ lb., syrup 2 qts., water 8 gal. Apply about 1 qt. to the tree, spraying the upper surface of the outer leaves only, when adult flies appear. This will be from June 8 to 20. Repeat application 10 days later and give a third spray 1 week after second.

Brown rot (Monilia) blossom blight. Same as No. 2 in prune schedule.

Cylindrosporium leaf spot (yellow leaf). Same as Nos. 3, 4 and 5, in prune schedule.

Brown rot on fruit. Use a wettable sulphur spray or sulphur dust 1 month before picking. Begin earlier if disease shows up sooner and repeat every 2 or 3 weeks till a month before picking.

APRICOTS

Brown rot (Monilia) blossom blight. Same as No. 2 in prune schedule. Where blossom blight has become very severe and in very wet springs a similar spray may be desirable as the winter buds open, and another about in full bloom. Prune out and destroy all dead twigs and spurs in winter.

Fruit spot (peach blight fungus). Same as Nos. 3 and 5 in peach schedule.

San Jose scale and other insects. Same control as for similar insects on peach.

Schedule 2. For semi-arid sections of the Northwest east of Cascade Range and for Rogue River Valley in Oregon.

APPLES AND PEARS

Scab. Present and troublesome only in a few localities. Where sufficiently abundant to justify spraying, apply Nos. 3 and 4 in Schedule 1 for apples and pears.

Powdery mildew. Use applications Nos. 2, 3, 4 and 5 in Schedule 1 for apples. Continue if necessary. Observe Footnote 2. Use casein spreader first dissolved in water. Supplement by winter and summer pruning out. Pink spray most important to avoid sulphur shock.

Codling moth. Following the calyx application, the first cover spray (15 to 30 day) is applied just before the first worms hatch. In general this will be earlier for interior (15 days) than for coast area. Follow with second cover spray 2 weeks after first cover spray; third cover spray 4 weeks later; and fourth cover spray 4 weeks after third. For southern Oregon additional late cover spray may be necessary. Double strength lead in late sprays advisable. Calyx spray on pears likewise advisable in southern Oregon. For eastern Washington, northern Idaho and the Grande Ronde Valley of Oregon, follow Schedule 1, although in higher altitudes probably 2 cover sprays will generally suffice.

Citrus red spider. Use spray No. 1 in Schedule 1.

Blister mite. Use spray No. 1 in Schedule 1. For apple, see Footnote 6.

Leaf rollers, fr it worms, San Jose scale, aphids. Follow Schedule 1 for these insects.

PEACHES

Leaf curl, mildew and California blight, twig miner, San Jose scale, spider mite. Follow Schedule 1 for these insects and diseases.

CHERRIES

Practically no fungous diseases requiring spray. Insects in general would require no regular program of sprays. For specific pests follow Schedule 1 for cherries.

APRICOTS

California blight. Follow Schedule 1 for peach blight. Insect pests and treatment same as for peaches in Schedule 1.

PRUNES AND PLUMS

No fungous diseases requiring spray as a rule.

San Jose scale, twig miner and spider mite are principal insect pests. Where present, control with spray No. 1 in Schedule 1 for prunes and plums.

FOOTNOTES

1. Where aphids are very bad, especially with varieties somewhat resistant to scab, omit nicotine from spray No. 2, adding it to spray No. 3, which should then be applied just as soon as blossom buds separate from each other. For severe infestations of brown aphids, the most satisfactory spray used in the Hood River Valley has been the oil spray applied as indicated in spray No. 1 just as the buds begin to show green. However, if blister mite is present, see Footnote 6.

2. Lime-sulphur will russet the skin of some varieties of pears like d'Anjou, Comice and Howell, and may cause burning of apples in hot weather. Under such circumstances substitute wettable sulphur spray (Footnote 9.)

3. Codling moth control is such a complex problem and of such outstanding importance that too much dependence should not be placed upon a general spray schedule of this nature. Supplement the suggested program with all the trained assistance and advice obtainable. The most important period in codling moth control begins with the calyx spray and extends for 4 or 5 weeks thereafter. Where worm losses have been heavy, keep fruit thoroughly covered during this period, as first brood worms are very active and the fruit rapidly loses its protective coating because of rapid growth. Because growers must eliminate arsenical residue on fruit for shipment, they should take extra care to control the first brood, giving an extra spray if necessary. No arsenical should be applied after mid-July, unless the worm situation positively requires it. The addition of 2 lbs. hydrated lime to 100 gal. of spray materially assists in the washing of fruit and also prevents arsenical calyx injury. Lime should be used in all late arsenical applications. The late cover spray may usually be omitted on pear. Supplement the spraying by careful collection of wormy fruit at thinning time; it pays. Scrape the scaly bark from the trees during February and March, band the trees in June, and destroy the accumulated worms every 2 weeks. For bad worm infestations, use 4 lbs. lead arsenate to 100 gal. throughout the season. Codling moth is not a commercial orchard pest of British Columbia, and no schedule of control is required.

4. Anthracnose or black spot canker and fruit rot may be successfully prevented by a single thorough summer application of 8-8-100 Bordeaux. Where the disease is reasonably well under control 12-12-100 Bordeaux in spray No. 2 is of much value in reducing infection without the disadvantage caused by the coating of the fruit with Bordeaux in the summer. The spring Bordeaux spray, however, must be applied before the fruit buds are much exposed, to avoid russeting. Bordeaux 12-12-100 applied with the oil spray is also proving of great value in the Hood River district in reducing anthracnose. In filling tank, add lime first. Fill tank two-thirds full; slowly add dissolved bluestone, lastly add oil, which, before adding, should be stirred up and emulsified with an equal amount of water. A very thorough application is necessary, as this spray must stay on the trees until fall, at which time it becomes effective in controlling the disease.

5. Leaf rollers occur as a major pest only in certain of our fruit sections. Oil emulsion in the early pre-pink (delayed dormant) is the standard spray. Where conditions develop that prevent maximum effectiveness from the oil spray and for very light infestations of leaf roller, use double strength lead arsenate (4 to 100) in the pink and calyx sprays.

6. For blister mite on apple, apply lime-sulphur 10 to 100 (12 to 100 if scale is present) any time after trees go dormant in the fall or in the spring before buds begin to open. Control cannot be obtained after green begins to show on buds. Oil 8 to 100 is effective during a much more limited time; this period is between the time scales are separating on buds and before green tips show. Warm, sunny weather greatly assists in increasing control. Every bud in the tree must be hit with the spray material, as the mites over-winter in the buds.

7. Three species of red spiders are troublesome in the apple and pear orchards of the Northwest. In some sections all are present; in others one or two of the three are present. Control measures for two are alike, but for the third species a different recommendation must be made. On account of this situation, it is necessary to know the particular spider giving trouble. The so-called European red spider and the brown mite over-winter in the egg stage on the tree. The third species, or so-called common red spider, hibernates in trash on the ground and is not on the trees when the first spray is applied. Oil spray at the rate of 3% or more is recommended for the first two species indicated. For the common red spider, the usually recommended sulphur sprays applied during early spring are quite effective. If all three of these pests are troublesome in the summer, a weak oil spray containing ½% to ⅔% of lubricating oil is recommended.

8. The directions in these schedules are based upon the use of lime-sulphur concentrate testing about 32 degrees Baume. Where the powdered or "dry lime-sulphur" is used, follow manufacturers' directions.

9. Within recent years substitutes for lime-sulphur, so-called wettable sulphur sprays, have been devised which do not have the caustic or burning action of the latter and hence are safer to use on tender-skinned varieties of pears and apples and on stone fruits. These sprays are not very active as fungicides or insecticides when the weather is cool and hence cannot always be relied upon for effective action in the early spring. They are, however, active in warm weather. It is usually advisable to employ a soap or casein spreader with them unless a spreader is used in the composition. These spray materials are much easier to prepare or use than the old self-boiled lime-sulphur and are to be recommended wherever the latter has been advised in the past. Among these wettable sulphur sprays may be mentioned the well-known atomic sulphur (use 12 lbs. to 100 gal.), "dry-mix" sulphur and lime, and "Oregon cold-mix" lime and sulphur. To prepare the latter, use superfine sulphur 16 lbs. hydrated lime 8 lbs. Mix together (thoroughness not required). Pour into the mixture 4 qts. milk (skimmed is entirely satisfactory) and stir into a smooth paste, adding water if too thick, and finally pour through strainer into spray tank with enough water to make 100 gal. Other satisfactory materials are now on the market.

10. The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

11. Oil sprays are increasing in popularity throughout the country. Up to the present time, however, observations made in Oregon at least do not seem to indicate that an oil emulsion of less than 6% should be recommended for the control of San Jose scale.

The California Schedules

Northern California

By LEONARD H. DAY
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ALMONDS

Shot hole. Lime-sulphur 10 gal., water to make 100 gal. Just as buds are swelling. This spray will also kill many of the almond mites (Bryobia) as they hatch from the winter eggs. It will also control peach twig borer. Bordeaux 4-6-100 as jackets are shed from young fruits is also very promising.

Red spider. (1) Heavy commercial oil (miscible or emulsion) 5 or 6 gal., water to make 100 gal. During dormant season, to kill eggs of Bryobia. (2) Dust with dry sulphur or use 1½% summer oil spray. As soon as mites appear and as often as necessary during summer, to kill adults of red and yellow mites. Dusting is less effective than spraying.

California peach borer. See under peaches.

Peach twig borer. See under peaches.

Red humped caterpillar. See under prunes.

APPLES

Pear blight. See under pears.

Mildew. Lime-sulphur 3 gal., water to make 100 gal., or sulphur paste 8 lbs., water 100 gal. When petals fall and several times during spring, combined with codling moth sprays. Apple trees are injured by sulphur sprays in some sections, especially if not sprayed in winter with lime-sulphur solution. Careful pruning of diseased twigs during winter aids in control. Consult county agent when disease is severe.

Scab. (1) Bordeaux 8-10-100, or lime-sulphur 5 gal., water to make 100 gal., as winter buds open. (2) Lime-sulphur 3 gal., water to make 100 gal., as petals fall. Later sprays necessary in coastal region, using lime-sulphur as above or Bordeaux 6-6-100 in sections where fruit is not russeted by this spray.

Codling moth. (1) Powdered, standard arsenate of lead 2½ lbs., water 100 gal., as petals fall. (2) Same as No. 1, 3 weeks later. (3) Same as No. 1, as needed. In many sections 2 sprays are sufficient. The calyx spray is most important. In other sections 4 to 7 sprays may be necessary. Clean up around packing houses. Strips of sack bands about trunk very valuable during spring and summer to assist in destroying worms before they become moths.

Flat headed apple tree borer. Borers hatch from eggs laid by beetles on sun-burned patches of bark. A strong solution of naphthalene-soap applied to sun-burned spots will repel the beetles. Whitewashing young trees helpful. Tree protectors more efficient than whitewash.

Leaf roller. Heavy commercial oil (miscible or emulsion) 5 or 6 gal., water to make 100 gal. Dormant season. To kill eggs, drench trees thoroughly.

Green and rosy apple aphis. (1) Lime-sulphur 10 gal., water to make 100 gal. Late dormant, just before buds open. Gives fair results in killing eggs. (2) Nicotine sulphate 1 pt., fish-oil soap 5 lbs., water 100 gal. From bursting of buds until leaf buds are ½ in. long. Results in somewhat better control than No. 1. (3) Nicotine dust 5% or 6%. From bursting of buds until leaf buds are ½ in. long. Material must be fresh and up to strength.

Red humped caterpillar. See under prunes.

Scale insects. Heavy commercial oil (miscible or emulsion) 5 or 6 gal., water to make 100 gal. Dormant season after first heavy rains. Lime-sulphur is sufficient for San Jose scale; others require heavy oil emulsion.

Tussock moth. Sprays ineffective. Destroy egg masses in winter. Band trees with Tanglefoot to prevent caterpillars from climbing trees.

Woolly apple aphis. Distillate emulsion or miscible oil, during winter months. P. D. B. in 2 rings around trees in fall for root form, in September-October. Delicious and Northern Spy nearly immune. Use refuse tobacco stems around roots of young trees or older trees in home yards.

APRICOTS

Bacterial gummosis. Cut out diseased bark and disinfect; when dry cover exposed wood with Bordeaux-oil paint. Winter and spring, or any time infections occur. Infections occur through wounds. Keep wounds covered with Bordeaux-oil paint. Inspect orchard at frequent intervals during winter.

Brown rot. (1) Bordeaux 16-16-100, during red bud stage. (2) Bordeaux 8-8-100, when about 1/5 of blossoms are open and up to full bloom. Cut out diseased twigs in winter or during summer if convenient. Remove fruit mummies. Avoid sulphur sprays on apricots.

Shot hole. (1) Bordeaux 10-10-100, November 15 to December 15. (2) Bordeaux 10-10-100, during red bud stage. (3) Bordeaux 4-6-100, when jackets drop. Spraying must be done thoroughly. No. 3 usually more important than No. 2.

California peach borer. P. D. B., in September-October. Soil should be warm for best results.

Leaf roller. See under apples.

Brown apricot and black scales. Refined commercial oil (miscible or emulsion) 5 to 6 gal., water to make 100 gal. December to February. This spray should not be applied until after first heavy winter rains. Cover new growth thoroughly.

Peach twig borer. Basic arsenate of lead 3 lbs., water 100 gal. When flower buds are swelled and ready to open. Do not use lime-sulphur spray on apricot trees. The lead arsenate can be combined with first brown rot spray.

Red humped caterpillar. See under prunes.

OLIVES

Olive knot. Cut out thoroughly at first appearance in late spring and summer and disinfect.

Black scale. Summer oils 1½% when young first hatch (August) or 2% when a few weeks old. July to September.

CHERRIES

Bacterial gummosis. See under apricots. Top-work seedlings of Mazzard or Mahaleb according to soil and locality.

Leaf and fruit spot (shot hole). See under apricots.

Black cherry aphis. Spray with nicotine sulphate 1 pt., summer oil 1½ gal., water to make 100 gal., or dust with 5% nicotine dust. As soon as aphids appear.

Cherry fruit sawfly. Basic arsenate of lead 3 lbs., water 100 gal. When petals are opening.

Cherry slug. Spray with basic arsenate of lead 3 lbs., water 100 gal., or dust with 2% to 5% nicotine dust. When slugs appear. May also be controlled with hydrated lime or even dry road dust.

Pear thrips. See under pears.

Red humped caterpillar. See under prunes.

GRAPES

Grape mildew. Finest forms of dry sulphur. (1) When new shoots are 6 to 8 in. long. (2) When new shoots are 12 to 18 in. long. (3) During or just preceding blossoming. In cool or moist locations, a fourth application when berries are as large as small peas may be necessary.

California grape root worm. Basic lead arsenate 8 lbs., water 100 gal. As soon as beetles appear in spring. Cultivate close to vines in winter to kill larvae.

Grape leaf hopper. (1) Nicotine sulphate 1 lb., liquid soap ½ gal. (or hard soap 1 lb.), water 100 gal. Before nymphs develop wings. (2) Calcium cyanide dust 50%, or nicotine dust 10%, or nicosulphur 6%. When adults appear. The nicosulphur will help control mildew.

Phylloxera. Use resistant vines. Disinfect cuttings or rootings before planting by dipping in hot water (122° F.) for 5 minutes. P. D. B. seems promising.

PEACHES

Peach blight. (1) Bordeaux 10-10-100. After first fall rains, November 15 to December 15, to prevent bud killing during winter. (2) Lime-sulphur 10 gal., water to make 100 gal. Pink bud stage in spring, just before petals expand. This also controls peach rust mite, peach twig borer, curl leaf and San Jose scale, and aids in control of mildew.

Brown rot. See under apricots.

Mildew. Dust with dry sulphur at first indication.

Black peach aphis. Nicotine sulphate 1 pt., fish-oil soap 5 lbs., water 100 gal., or summer oil 1½% in place of soap. As soon as insects appear.

Black scale, brown apricot scale. See under apricots.

Flat headed apple tree borer. See under apples.

Peach rust mite. Lime-sulphur 10 gal., water to make 100 gal. Dormant season.

Peach rust. Lime-sulphur soution 6 gal., water to make 100 gal. Between October 15 and November 1, even if leaves have not fallen.

California peach root borer. P. D. B. 1 to 1½ oz. per tree at base about 3 in. from trunk and mound with earth. In September-October. Soil should be above 55° F. for best results.

Peach twig borer. Lime-sulphur 10 gal., basic arsenate of lead 3 lbs., water to make 100 gal. Pink bud stage. Clean up around packing house. Burn old prunings. Spray must cover all young growth.

Curl leaf. Spring spraying for blight and twig borer controls curl leaf. The fall spraying for blight also aids.

Red spider. See under almonds.

San Jose scale. See under apples. December to February.

PEARS

Black end. No remedy known. Seems to be associated with Japanese rootstocks. Inarching large-sized seedlings, planted near the trunk, is promising.

Pear blight. Spraying ineffective. Cut out affected parts. Remove holdover cankers in large branches, trunk and roots during winter. Disinfect tools and cuts with mercuric chloride and mercuric cyanide, 1 part each to 500 of water. New cankers on large branches may be cured by scarification or by the zinc chloride treatment. See Extension Circular No. 20, Calif. College of Agriculture. Consult county farm adviser and horticultural commissioner. Avoid stimulating rank growth. Topwork on resistant roots or trunks. Inspect orchard frequently during spring and fall.

Pear scab. (1) Bordeaux 8-10-100, or lime-sulphur 1-10, while bud scales are loosening up in spring just enough to show the group of flower buds inside. Lime-sulphur is usually preferred because it also assists in control of blister mites, rust mites and certain scale insects. (2) Bordeaux 8-10-100, a week or 10 days after first application, just before petals expand. (3) In some districts later applications also necessary, combined with codling moth sprays.

Scale insects. See under apricots.

Pear slug. See under cherries.

Codling moth. See under apples. Two applications usually sufficient.

Fruit tree roller, green apple aphis. See under apples.

Italian pear scale. Crude oil emulsion. January or February. Drench branches and trunk.

Pear leaf blister mite. Lime-sulphur 10 gal., water to make 100 gal. November or February. The November spray is most successful.

Pear root aphis. P. D. B., in fall. See Bul. 411, Calif. College of Agriculture.

Pear thrips. Distillate emulsion 5 gal., nicotine sulphate ½ pt., water to make 100 gal. As soon as black thrips appear in blossom buds. Again if necessary. Winter cover crop if not plowed under too early keeps thrips in ground until after blossoming season.

Red humped caterpillar. See under prunes.

San Jose scale. See under apples. Controlled also by the spray for Italian pear scale.

PLUMS AND PRUNES

Brown rot. See under apricots. Sometimes serious on sugar prunes.

Scale insects. See under apples. Italian pear scale often serious.

Cherry fruit sawfly. See under cherries.

Flat headed apple tree borer. See under apples. Often serious on young trees.

Fruit tree leaf roller. See under apples.

Mealy plum louse. Summer oil 1½%. When insects appear. Spraying must be done before leaves curl. Winter spraying for scales also kills eggs on trees.

Peach twig borer. See under peaches.

Pear thrips. See under pears.

Red humped caterpillar. Dust with equal parts arsenate of lead and hydrated lime. Whenever insects appear. Young caterpillars killed more easily than old ones.

Tussock moth. See under apples.

Red spider. See under almond. Summer oil especially recommended for interior valleys.

WALNUTS

Blight. No specific remedy. Plant resistant varieties. Control of aphids helps.

Codling moth. (1) Basic arsenate of lead 3 lbs., water 100 gal. (2) Dust with arsenate of lead 50%, hydrated lime 50%. When first observed in May and June. Time of spraying depends on climatic conditions.

Red humped caterpillar. See under prunes.

Walnut aphis. Dust with 2% nicotine dust. Last of May or first of June. Second application often necessary in July or August.

CURRANTS AND GOOSEBERRIES

Mildew. Lime-sulphur 3 gal., water to make 100 gal. As buds begin to open and 2 or 3 times thereafter at 2-week intervals. In California a dormant spray of lime-sulphur 10 gal., water to make 100 gal., followed by dusting with sulphur, often effective.

Currant and gooseberry fruit fly. Spraying ineffective. Cultivate thoroughly in winter and spring.

Imported currant borer. Spraying ineffective. Cut out and burn infested canes.

Red spider. Wettable sulphur 5 lbs., water 100 gal. When mites appear.

BRAMBLES (BLACKBERRIES, RASPBERRIES)

Cane blight, leaf spot. Bordeaux 10-10-100, or lime-sulphur 10 gal., water to make 100 gal. During dormant season. Cut out and burn infected parts; renew old plantings.

Anthracnose. Control measures not yet worked out for California conditions.

Orange rust. Cut off diseased parts and burn. Dormant spray with Bordeaux or lime-sulphur recommended for trial.

Raspberry horntail. Cut off young tips as soon as wilting is noticed. Remove dead canes in winter. Dig out borers.

Rose scale. Distillate oil emulsion or miscible oil. Dormant season. Lime-sulphur also gives some control.

Red berry mite. (1) Lime-sulphur 10 gal., water to make 100 gal., when growth starts in spring. (2) wettable sulphur 5 lbs., water 100 gal., in summer. Only serious on Himalaya variety.

STRAWBERRIES

Leaf spot. Bordeaux 10-10-100. Dormant season. Clean up and burn leaves in fall.

Strawberry aphis. Nicotine dust 5%. When aphids appear. Apply dust to underside of leaves.

Strawberry crown moth. Spraying ineffective. Remove and burn infested plants. Plant only clean stock.

Strawberry leaf beetle. Spray with basic arsenate of lead 3 lbs., water 100 gal., or dust with arsenate of lead 20%, hydrated lime 80%. When pest is discovered. Infested plants should be destroyed.

Red spider. White lubricating oil emulsions. When mites appear. Avoid use of sulphur dusts or sprays.

Yellows. Difficult to control. See farm adviser or county horticultural commissioner.

FIGS

Souring. Dispose of all fruits in which insects breed and winter. Caused by yeasts carried into fruits by insects.

Soft rot. Fungus carried by fig wasp. Disinfected Capra figs are being tried as source of fig wasp for cross-pollinating.

Splitting. Due to climatic and soil moisture conditions.

Mediterranean fig scale. Refined commercial oil (miscible or emulsion) 5 to 6 gal., water to make 100 gal. Dormant season. These scales resemble oyster shell scales and infest limbs, twigs, leaves and fruit.

Nematodes. No remedy known. Becoming serious in some sections.

Smut. No remedy known.

Arsenate of lead. These directions are based on powdered arsenate of lead; if the paste form is used, double this amount.

Lime-sulphur. These recommendations are based on commercial lime-sulphur solution concentrate testing 32 to 33 degrees Baume.

Refined oils. Commercial emulsions and miscible oils are made from either heavy or light refined oils.

Wettable sulphur. Commercial wettable sulphurs are the most satisfactory.

P. D. B. Paradichlorobenzene, a soil fumigant on the market in the form of white crystals.

Summer oils. Specially prepared refined oils for summer use, on the market as emulsions.

Disinfectants. Use cyanide of mercury and bichloride of mercury, 1 part each to 500 parts water.

Bordeaux-oil paint. Stir raw linseed oil into any one of the Bordeaux powders found on the market. This makes a durable disinfectant paint.

Southern California

By E. O. ESSIG
University of California

The recommendations in this schedule apply to the entire state of California as well.

APPLES

1. Dormant spray. Before buds begin to open. Lime-sulphur 10 gal., water to make 100 gal., or any of the oil sprays (Note 1), for San Jose scale, oyster shell scale. Miscible oil or crude oil sprays (Note 1), for fruit tree leaf roller, San Jose scale, oyster shell scale. Use coarse, driving spray.

2. Cluster-bud spray. When buds begin to separate but before they open. Lime-sulphur 3 gal., basic arsenate of lead 2 lbs., water to make 100 gal., or basic arsenate of lead 2 lbs., 8-8-100 Bordeaux, for apple scab, mildew, fruit tree leaf roller, aphis. Add ½ pt. nicotine sulphate when aphids are present.

3. First codling moth spray. When most of petals have fallen. Lime-sulphur 3 gal., basic arsenate of lead 2 lbs., water to make 100 gal., or basic arsenate of lead 2 lbs., 8-8-100 Bordeaux, for codling moth, scab, aphis, mildew. For mildew add 8 lbs. sulphur to each 100 gal. of arsenate of lead solution. For aphis add ½ pt. nicotine sulphate. For codling moth, repeat application in 3 weeks and again in 8 to 10 weeks.

PEARS

1. Dormant spray. Before buds begin to open. Lime-sulphur 10 gal., water to make 100 gal., or oil sprays (Note 1), for San Jose scale, oyster shell scale, Italian pear scale. Apply

spray thoroughly to all parts of trees. Miscible or carbolic oil sprays (Note 1), for mealy bugs. Scrape bark and make one or more applications of spray.

2. Cluster-bud spray. When buds begin to separate but before they open. Lime-sulphur 2½ gal., basic arsenate of lead 2 lbs., water to make 100 gal., or basic arsenate of lead 2 lbs., 8-8-100 Bordeaux, for codling moth, blister mite, cankerworms, scab. For codling moth repeat application in 2 or 3 weeks. Spray with (1) miscible oil 3 gal., nicotine sulphate 1 pt., water to make 100 gal., or (2) highly refined lubricating oil emulsion 4 gal., water to make 100 gal., or dust with nicotine dust, for pear thrips. Repeat applications as necessary.

3. Fall spray. November. Lime-sulphur 8 gal., water to make 100 gal., for pear leaf blister mite. This is the most important time to spray for this pest. Over-wintering mites frequently kill the buds if spraying is delayed until spring.

APRICOTS

1. Dormant spray. Before buds begin to open. Lime-sulphur 10 gal., water to make 100 gal., or 8-8-100 Bordeaux, for peach blight or shot hole fungus, brown rot. Oil sprays (Note 1), for brown apricot scale. Spray new growth thoroughly.

2. When buds are bursting and first few blossoms appear. Lime-sulphur 10 gal., basic arsenate of lead 3 lbs., water to make 100 gal., or basic arsenate of lead 3 lbs., 8-8-100 Bordeaux, for peach twig borer, shot hole fungus or peach blight, leaf curl.

PEACHES

1. Dormant spray. Before buds begin to swell. Lime-sulphur 10 gal., water to make 100 gal., or 8-8-100 Bordeaux, for peach blight or shot hole fungus, peach leaf curl. These sprays are preferably made in November. Bordeaux mixture now preferred in California. Lime-sulphur 10 gal., water to make 100 gal., or oil sprays (Note 1), for San Jose scale. Thoroughly cover entire tree.

2. When buds begin to swell and first few flowers open. Lime-sulphur 10 gal., basic arsenate of lead 3 lbs., water to make 100 gal., or basic arsenate of lead 3 lbs., 8-8-100 Bordeaux, for peach blight or shot hole fungus, peach leaf curl, San Jose scale, peach twig borer. Use Bordeaux in sections where injury is caused by lime-sulphur.

3. Summer sprays. Spray with (1) lime-sulphur 2½ gal., water to make 100 gal., or (2) wettable sulphur (Note 2), or (3) highly refined lubricating oil emulsion (Note 1), or dust with dry sulphur, for red spider. Apply whenever spider appears and repeat if necessary. Keep soil well supplied with moisture. 2% summer oils have proved very satisfactory, for red spider.

PLUMS AND PRUNES

1. Dormant spray. Before buds begin to swell. Lime-sulphur 10 gal., water to make 100 gal., for peach blight or shot hole fungus, San Jose scale. Oil sprays (Note 1), for San Jose scale, Italian pear scale. Add 4 lbs. caustic soda to oil spray to remove moss or lichens.

2. Cluster-bud spray. When buds begin to separate but before they open. Spray with (1) miscible oil 3 gal., nicotine sulphate 1 pt., water to make 100 gal., or (2) highly refined lubricating oil emulsion 2 gal., water to make 100 gal., or dust with nicotine dust, for pear thrips. It may be necessary to make added applications when blossoms open and fruit is in the jackets.

3. Summer sprays. When trees are in foliage. Spray with (1) lubricating oil emulsion 1 gal., water to make 100 gal., or (2) wettable sulphur (Note 2), or (3) lime-sulphur 2½ gal., water to make 100 gal., or dust with dry sulphur, for red spider. Apply when mites appear. Use 2% summer oil until fruit is nearly ¾ mature. Highly refined lubricating oil emulsion 2 gal., water to make 100 gal., or whale oil soap 5 lbs., water to make 100 gal., for mealy plum aphis. Care must be taken to thoroughly drench the undersides of the leaves.

BERRIES

1. Cluster-bud spray. When blossom buds are formed and before they open. Lime-sulphur 2½ gal., water to make 100 gal., or wettable sulphur (Note 2), for mite causing redberry disease of Himalaya blackberry, Loganberry and Mammoth blackberry. If this application is not made, use wettable sulphur at any time during early summer before berries are half grown.

2. Summer sprays. Highly refined lubricating oil emulsion (Note 1), for strawberry aphis, red spider on various berries. Apply to both surfaces of leaves.

CITRUS FRUITS

1. Fall, winter and spring. Fumigate with HCN gas, or spray with highly refined oil emulsion (Note 1), for scale insects. Spraying must be done thoroughly. Follow recommendations as to dilution and times to apply. Bordeaux 8-8-100, for brown rot.

2. Spring, summer and fall. Spray with (1) lime-sulphur 2 gal., water to make 100 gal., or (2) wettable sulphur (Note 2), or (3) highly refined lubricating oil emulsion (Note 1), or dust with dry sulphur, for red spider. Apply as soon as mites appear and as often as necessary. Lime-sulphur 2 gal., nicotine sulphate ¾ pt., water to make 100 gal., or highly refined lubricating oil emulsion (Note 1), for citrus thrip. Two or more applications may be necessary.

WALNUTS

1. May, June or July. Spray with basic arsenate of lead 3 lbs., water 100 gal., or dust with arsenate of lead 15%, hydrated lime 85%, for codling moth. Begin applications as soon as work on green husks appears. Nicotine dust 2%, for walnut aphis. Apply when aphids appear.

FIGS

1. Dormant spray. Before buds begin to swell. Lime-sulphur 10 gal., water to make 100 gal., or oil sprays (Note 1), for fig scale.

ALMONDS

1. Dormant spray. Before buds begin to swell. Lime-sulphur 10 gal., water to make 100 gal., for red spider eggs, peach blight or shot hole fungus, brown rot, San Jose scale.

2. When buds are swelling and first few flowers are opening. Lime-sulphur 10 gal., water to make 100 gal., for red spider, peach blight, brown rot, San Jose scale, peach twig borer. Make thorough applications.

3. Summer spray. When trees are in foliage. Spray with (1) highly refined lubricating oil emulsion (Note 1), or (2) wettable sulphur (Note 2), or (3) lime-sulphur 3 gal., water to make 100 gal., or dust with sulphur, for red spider. Apply when mites appear in early spring and summer.

GRAPES

1. Early spring. When new shoots are 6 to 8 in. long and again when fruit is size of buckshot. Dust with dry sulphur, for mildew. Make one or two applications.

2. Spring and summer. Spray with nicotine sulphate ½ pt., hard soap 1 lb., water 100 gal., or dust with 50% calcium cyanide, for grape leaf hopper. Apply when nymphs or young first appear.

OLIVES

1. Winter. During December, January or February. Oil sprays (Note 1), for ivy scale, black scale.

Note 1. There is a great variety of oil sprays on the market. Growers are advised to consult with their local horticultural commissioner or county agent before buying and using oils, or to follow the manufacturers' directions in regard to dilution.

Note 2. Wettable sulphur is made of 8 lbs. hydrated lime, 16 lbs. superfine sulphur and 1 lb. calcium caseinate. The materials can be mixed dry in advance and stored for use. In preparing the dilute spray, fill the spray tank half full of water, then with agitator running, add the dry materials slowly, directing the spray nozzle upon the material until it has disappeared in the water. In the formulas given in this schedule, 5 lbs. of dry mixture are used for 100 gal. of dilute material. Wettable sulphur can be made in the orchard by putting given amount in a large can or in a keg and treating it by applying water under 200 to 300 lbs. pressure through a spray gun or spray rod. It requires about 5 minutes to thoroughly wet the contents of a 5-gal. can.

Arsenate of Lead. The directions in these schedules are based upon powdered arsenate of lead: if the paste form is used, double the amount. If combined with lime-sulphur or Bordeaux mixture, the neutral or basic form is to be preferred. The neutral or basic form should also be used in the fog belt along the coast.

Lime-Sulphur. The directions in these schedules are based upon the use of lime-sulphur concentrate testing 33 degrees Baume. Applications of this material in hot, dry weather should be avoided.

Nicotine Sulphate. The directions in these schedules are based upon the use of 40% nicotine sulphate.

Dusts. Nicotine dusts and calcium cyanide dusts are available in various strengths. The former are also available in combination with the lime-sulphur, arsenate of lead, etc.

Some Fruit Recipes

Dutch Apple Pudding

2 c. flour
1 t. salt
1½ t. baking powder
1 egg
2 T. butter
⅔ c. milk
4 large apples

Sift flour with salt and baking powder. Rub butter into flour. Add milk and well beaten egg to flour, and mix quickly and well. Spread dough one-half inch thick on buttered baking pan. Cut peeled and cored apples into eighths and stick these into dough in rows. Sprinkle with sugar (and spice, if desired). Bake 25 minutes in moderate oven, or until apples are tender. Serve with a fruit sauce or with cream. An interesting variation is to shape the dough into individual round tarts, arrange the apples in circles or stars, and bake in that form. Serve with fruit sauce or cream, as above.

Apple Loaf

Take enough bread dough to make one small loaf. Work into this 1 T. butter, ⅓ c. sugar, ½ t. cinnamon, and 1 egg well beaten. Add enough flour to form a dough that can be kneaded. Knead until well blended, then let rise in a warm place. Divide dough into three equal parts; roll each to fit the loaf pan. Then put one layer into buttered pan, spread over with a layer of finely chopped, easily cooked apples. Pour over melted butter and sprinkle with cinnamon. Lay a second piece of dough on top and proceed as above. Finally add last layer of dough. Let rise again, and when very light, brush over with milk, steam 1 hour, and then brown lightly in the oven. Serve in slices with a pudding sauce.

Fried Apples

Quarter and core 6 unpared apples. Put into a skillet 1 c. sugar, 1 T. butter and 3 T. of water. When this is melted, put in the apples, skin side up. Cover and fry very slowly until tender and browned, turning just once, before the fruit is too well cooked, in order to brown both sides.

Stuffed Baked Apples

For each person to be served pare and core 1 apple, or, if preferred, core without paring. Place apples in baking dish, fill each apple with 2 t. drained crushed pineapple, 1 T. sugar and 1 t. butter. Surround with pineapple juice and with boiling water, if necessary. Bake until fruit is tender in hot oven for approximately 50 minutes, basting frequently. Put a round marshmallow on each of the apples, return to the oven until brown and serve hot with the syrup, or cold with top milk or cream.

Peach Sherbet

2 c. peach pulp
Juice and rind of 1 lemon
1 c. sugar
2 egg whites

Press seeded and skinned peaches through a colander. Boil sugar and water together 5 minutes. Cool, add lemon juice, grated rind and peach pulp, and freeze to a mush. Add the stiffly beaten egg whites and freeze until firm. Pack and allow to stand two hours or more.

Prunes with Rice

Pack hot boiled rice in buttered cup. Turn out at once into individual cereal bowls, surround with drained stewed or steamed prunes, or canned prunes with their juice. Serve with cream and sugar. Makes tasty breakfast or supper dish.

Operating the Air-Cooled Storage

(*From Page Seven*)

considered to be the most desirable storage containers. Numerous types of ventilated crates are available, either in the rigid or the collapsible form. The storing of apples in large bins is not an efficient method, as there usually is more bruising, more rotting and a greater general accumulation of storage troubles than when crates are used. Stack the crates in straight lines, leaving a space of six to eight inches next to all walls and a space of two inches between rows of crates. Aisles should be left at convenient intervals. As the upper part of the room is the warmest, no fruit should be stored in the upper three feet. This space should be left for the accumulation of warm air. This is another essential feature of successful cool storage management that frequently is ignored and as a result much fruit is needlessly wasted by being exposed to an unfavorable condition. In marketing fruit from storage, it is well to remember that the fruit in the upper part of the stack is likely to be the ripest and that most in need of an early market.

If no permanent false floor has been provided, the fruit may be raised a short distance by placing four or six-inch timbers upon the floor and laying strips across these to furnish channels for the circulation of air beneath the fruit.

Attention to these details of management will add greatly to the efficiency of any air-cooled storage, and the operator will be well repaid for the small amount of extra work involved.

How Shawnee Saved Her Trees

(*From Page Four*)

spray oils are readily available, and Mr. Berry has found them very effective in cleaning up the San Jose scale with which his district was infested. Aside from the saving in material cost, it is much more pleasant to handle, and it does not injure the paint on adjacent buildings. Lime and sulphur spray has a decidedly caustic action on all painted surfaces.

Mr. Berry says: "The low cost of our co-operative service is not due to the fact that we use some school labor. We hire a great deal of the work done, and it is quite possible the work would move more efficiently if only skilled workers were employed. I believe if a community is going into this sort of thing the ring should be organized to give actual service to the community supporting it, and should be operated on a large enough scale to be really effective. We spray everything from the tallest trees to cabbages and roses."

Cost of Operation

An itemized statement of operating costs for 1928 is given, this season being, as stated before, a poor fruit year in the Middle West:

Total receipts	$1,096.19
Labor—	
Men	363.24
Boys	76.81
Material	153.60
Gas and oil	47.15
Repairs	33.99
Repairs on trucks	32.95
Replacement of equipment (payment on new truck)	300.00
Total	$1,007.74
Balance	88.45
Total receipts	$1,096.19

The education of the community to proper spraying methods has not been the least important part of the project. Fruit growers here have been shown the benefits of good spraying, and they have learned also that spraying cannot insure fruit in an otherwise neglected orchard. They have learned that spraying must be augmented by fertilization, pruning and cultivating. Mr. Berry says that spray work cannot be taught to future growers in the classroom only, but that actual experience on the rig is vital.

"They tell me you have a model husband, Mrs. Hicks."

"Yus, sir, but 'e ain't a workin' model.

Have You Ever Sprayed at Night

(*From Page Eight*)

the egg or the body of the insect and the material used for control, most of the spray protection available for the year 1929 is for preventive use. This requires, therefore, that the materials be applied in advance of the danger stage of disease or insect. To do this involves, primarily, proper spraying preparedness and management of equipment. *If fruit growers would change their methods of protecting crops as often as they change the ingredients of their protection, perhaps the results of our spray technic would be as certain as the expectancy of the ingredients employed.* The weak and uncertain side of the protective program appears to be—was it applied seasonably?

Rapid Coverage Offers Hope

The largest number of growers who net the greatest returns in the face of epidemic seasons, when half of their competitive neighbors are failing, are those managers who have 24-hour protection for susceptible variety units.

Spray protective equipment is not unlike the automobile in cost of upkeep and length of life. Orchard protective equipment is used but a very few hours per year, and in terms of emergency preparedness, it is often out of order more hours than it is in use. The equipment for guarding these important fruit and vegetable crops can be made to double the acreage it has been serving, if a few changes in practice are employed. Any change that will shorten the transportation and loading time of any liquid sprayer should be adopted at once. Faster spraying and more hours of use of equipment, when conditions warrant and when weather and soil conditions are very favorable, would better the control.

Night Spraying Gaining Favor in Middle West

Many states in the "corn belt" have, in recent years, mounted lights on sprayers and dusters, for the peak loads of the spring and for emergency situations. It seems delightfully sound in economics and management to make equipment do double the work, when desirable, and what is more important—increase the protection to the crop. The greatest enemies of liquid spraying are: wet foliage and fruit, wet ground hampering traction, or a counterpart—dry sand, and no small consideration is the cost and dissatisfaction of spraying when the wind is blowing. Yet most of the spraying of North American fruits is performed when the wind is blowing.

Conditions operating against efficient use of dusting equipment are: dry atmosphere, insufficient lift and penetration of the air carrier, and the greatest of all, wind. No small item is the lack of experience of the operator in choosing conditions and in regulating dosage and machine capacity to the conditions at hand.

More Hours or More Equipment

From the way in which many of the working angles in spraying management have been herein presented, it appears to resolve itself into a question for the orchardist, who wishes better results from spray cost, of utilizing equipment for more hours of each 24 or purchasing equipment that will do as much work in less time.

Fortunate it is that the more efficient captains of the fruit industry are quick to see a point of vantage. These successful orchardists are, beyond question, as brainy and crafty a group of individuals as can be found in any branch of agriculture. It is only natural, then, that the writer should hear of dozens of orchards where portable lighting units have been mounted on sprayers and dusters. The essence of thorough night work lies in the quality of the light. The nozzleman must have a bright light that will cover the pattern—one with no glare or focus. The tractor driver or teamster should, by all means, be given a focused beam headlight so that he may drive with nearly the same certainty as in daylight. By no means should the sprayman's light be used to share as a driver's light.

There are signs on the horizon that agriculture is slowly following in the footsteps of other industries in the adoption of "shifts" in production. The night shift is here in many fruit districts and is perhaps the first branch of agriculture to adopt it to a production practice. Two labor shifts are on the way in the field practices of farming. In the wake of night work follows two shifts of labor, in certain seasons. And after that, what? Will it be three farm shifts on the same equipment instead of three sets of equipment and three sets of labor to do a farm operation, as is now the vogue on the larger farms operated largely by daylight?

Tillage an Aid to Control Work

(*From Page Seven*)

cultivation should generally be given between rains.

Cultivation Conserves Moisture

Killing and keeping down weeds near trees has a greater influence on young trees than old ones. This is mainly due to increasing the water supply in the soil. Some of the principal ways by which cultivation conserves moisture are: (1) by reducing the soil particles to a fine state of division; (2) by preventing the washing of soil and increasing the water-holding capacity; and (3) by adding humus and green manures to the soil.

Cultivation during the latter part of August and early September is likely to induce a late growth on fruit trees which will not have time to harden and mature for winter conditions. Late growth induced by cultivation, fertilization or pruning may result in much winter injury. This may be particularly true if unusually low temperature is experienced in the early part of the winter season. Cultivation should, therefore, as a rule in the central states be stopped about the first of July in order to allow the trees to slow up in growth and prepare their tissues for winter conditions.

Many growers have solved the problem of preventing their trees from making a late fall or early winter growth by sowing a cover crop in early July. If the crop grows vigorously, it takes moisture and other foods from the soil to such an extent as to slow up the growth of the trees and thus allow them to harden and mature for the winter. Usually the best cover crop consists of cowpeas or soybeans sown in the drill. Such crops have an additional advantage in that they are nitrogen-gathering plants, and where they grow the producer may be assured of the storage in the soil of the cheapest available supply of nitrogen, the element most needed by fruit plants.

Proper Orchard Implements Important

Where the orchardist can have the right implement for the particular kind of work for which it is best adapted, he is, indeed, fortunate. He will also be able to do more and better work if the implements have been kept in the best condition and are available for work when needed.

Many growers who handle a rather extensive acreage have found that the tractor may replace horsepower to advantage. This will be particularly true on land and soils where tractors may be operated efficiently and where the acreage is enough to justify additional expense. The tractor will be able to cover the land much more quickly and at the same time supply additional power for better work.

Moreover, it may often happen during the winter, spring or summer that there are only a few days during which the soil works well. If sufficient team power is not available, much cultivation may be neglected on account of the inability of the grower to do the tillage work rapidly. This, of course, results in an increase of injurious pests, more expense for spraying materials and labor, and too often lower grade and less fruit is received through decreased tree vigor.

Cultivation, like spraying, should be performed at the proper time and under the right conditions if it is to be of the greatest value. Implements which will do the work in the least time and in the most efficient manner are generally the cheapest in the long run.

New Sulphur Dust Combinations

(*From Page Five*)

A Promising New Dust Combination

It was thought that a number of points of failure of ordinary sulphur dusts could be eliminated by making a combination with 300 mesh ground roll sulphur and dry lime-sulphur. It has long been known that the initial killing factor of lime-sulphur is due to its caustic nature, and that its lasting fungicidal action is due to the deposit of sulphur on the leaves. It is also an established fact that sulphur deposited from liquid or dry lime-sulphur sticks to the foliage as no other form of sulphur does. It was thought that if dry lime-sulphur could be ground fine enough and mixed with finely ground roll sulphur it might aid in the sticking and killing power. Four of the most promising mixtures were then tested in the field. These were (a) 85 pounds of sulphur and 15 pounds of dry lime-sulphur; (b) 90 pounds of sulphur and 10 pounds of dry lime-sulphur; (c) 85 pounds of sulphur, 10 pounds of dry lime-sulphur and five pounds of hydrated lime; (d) 85 pounds of sulphur, 10 pounds of dry lime-sulphur and five pounds of bentonite clay. These formulas were used in the pre-blossom and blossom applications. For petal-fall and subsequent applications, 10 pounds of arsenate of lead replaced 10 pounds of the ground roll sulphur. Three hundred mesh ground sulphur and one standard commercial mixture were used as a check on the new dusts.

The dust applications were made according to the time of the scab spore discharge until June 15 and thereafter, when needed, depending upon rains and development of new growth. In all, seven applications were made. The tests were made in three sections of the state of Ohio, one in the southern fruit-growing section, another at the station, and the third in the Bingham orchard at Chardon. The results in southern and central Ohio were negative in that all the dusts used gave perfect control. While scab was prevalent in both places, the weather was not favorable for its development, and, consequently, it was not difficult to control. The test at Chardon was entirely different. Scab was late in starting, owing to a short spring drought, but about petal-fall time it began to rain, and from then until the first of August rains were very frequent. Scab developed rapidly and was difficult to hold. The variety used in this test was Stayman Winesap.

The results of the tests are summarized in the table on page five.

The 85-15 sulphur-dry-lime-sulphur dust gave excellent control, much better than any of the standard dusts now generally used. The apples on the check trees were a total loss. When you compare the results obtained in the table, you can readily see that sulphur dusts will hold scab even under severe conditions. Even where the ordinary commercial dusts, such as pure sulphur or sulphur mixture, were used, not a severe loss was obtained. The best dry lime-sulphur mixture was as good as could have been expected with a standard spray.

The results of all these tests indicate plainly that dusts have a place in disease and insect control. In the large southern Ohio apple-growing region, where lime-sulphur does its greatest damage, dusts gave almost perfect control. In most years, if scab caused a loss of 10 per cent, the injury from lime-sulphur would be twice or more than that. The same is frequently the case in northern Ohio. On the other hand, sulphur dusts give no injury. The sulphur-dry-lime-sulphur dusts showed no evidence of injury. It is true that injury can be reduced by adding hydrated lime to lime-sulphur sprays, but in doing this, the effectiveness is reduced even lower than that of dusts.

It would appear from our results that we now have a dust mixture that will control scab under severe conditions. These results, however, are for only one season and should not be given as final. On the other hand, conditions for scab control were severe, much more so than normal, and the 85-15 mixture held the scab almost perfectly.

Summer Oils in Orchard Practice

(*From Page Ten*)

an infestation following application rather than any great immediate contact-killing effect on forms of psylla present when the treatment is applied. It has been consistently noted that the immediate kill is less with oil than with nicotine, for example, but that on oil-sprayed trees the infestation rapidly and progressively becomes less and less severe, and finally negligible.

Supplementary Values of Summer Oil Sprays in the Orchard

While attention has been directed primarily toward the value of oil for codling moth control, its probable incidental effect on other insects which may be present may well be considered. A few of the more important species upon which the summer oil spray may exercise some degree of controlling influence are: Scale insects, particularly the San Jose scale, leaf hoppers, aphids, red mite or red spider, leaf feeding caterpillars, and plant bugs.

There is little experimental or observational evidence available as yet showing the effect a summer oil may have on some of these insects, and the inclusion of such species in the above list is suggested only by inference based on a general knowledge of the properties of oil, the character and habits of the insects, and results of tests of oil on the same or similar species on other crops.

However, some observations have been made on the reaction of certain species to oil applications, and with others the inferential evidence is really very strong. The status of those outlined above may be briefly summarized as follows:

San Jose Scale and Leaf Hoppers

It is certain that the use of a summer oil will aid in controlling San Jose scale, where an appreciable infestation exists in the orchard during the summer. Definite evidence of this was observed in a middle western orchard in 1928, examination of the fruit from plots receiving no oil spray showing considerable scale infestation at harvest, while that from the oil-sprayed plots receiving three applications of two per cent summer oil in the second brood sprays was almost completely clean.

In another orchard, leaf hoppers were noticeably abundant, and injury to the foliage of trees receiving no oil was marked. While the plots sprayed with oil also showed leaf hoppers and some injury, the infestation was noticeably less.

Aphids and Red Mite

Second brood sprays only of oil probably would exercise little influence on aphids or their characteristic injury to fruit or foliage. In two orchards, however, where summer oil was applied in earlier sprays, it was noted that a decidedly higher percentage of the fruit from plots receiving no oil showed aphis injury than that from the oil-sprayed plots.

There seems little doubt but that the use of summer oils will have a decided effect in controlling summer infestations of European red mite, or common red spider, or of clover mite, where such infestations occur. The strongly destructive properties of this class of oils on the summer forms of these pests has been positively evident from tests conducted on other hosts.

Leaf-feeding Caterpillars and Plant Bugs

Little or no positive experimental evidence of the effect of summer oil sprays on these classes of insects in the orchard is available, although there is some experimental evidence showing a quite decided effect of such oils on similar insect life on other plants.

Iron Sulphate Reduces Injury

(*From Page Three*)

ment. The leaf is what might be called the "lungs" of the plant, as the exchange of oxygen and carbon dioxide goes on through the leaf, and most important of all, perhaps, is the fact that the leaf is a real manufacturing plant. It combines the carbon dioxide from the air with water from the soil to form what eventually are sugars and starch. This is known as photosynthesis, but it can occur only through the action of sunlight on chlorophyll, the green pigment of the leaf. Some of the products of photosynthesis are combined in the leaf with minerals, such as nitrogen, that are brought up from the roots.

The products that are built up in the leaf are used by the plant to form more wood and leaves, new buds that develop into spurs or blossoms, to increase the root system and woody tissues. Most important of all, from the fruit grower's point of view, is the utilization of these products formed in the leaf to make apples. The proper functioning of leaves that are present in sufficient numbers is one of the necessary requirements if the grower is to harvest apples of good size, quality and color.

Effects of Spray Injury

Let us consider now how foliage injury may affect the grower's pocket-book, which in the end is the real determining factor in deciding whether any spraying material is desirable. An orchard, to be profitable, must produce reasonable numbers of apples of good grade, and grade is determined largely by size, color, finish and freedom from injury by insects and diseases. Many factors have a bearing on these points, but spraying material certainly is one of the most important. Spraying materials are important, first, in the control of insects and diseases, and, second, because of their effect, directly or indirectly, on the fruit and foliage.

One of the most commonly recognized forms of spray injury is that to the fruit itself. This is usually called "russeting," and, so far as known, its effect is entirely immediate and is injurious just to the extent that it affects the grade of the apples in question.

Effect on Fruit-Set. Injury to foliage may be seen just as easily, but its effect often is not so easy to comprehend. One of the most talked of effects of spraying materials has to do with the set of the fruit. Nearly everyone has heard it said that the use of lime-sulphur and lead arsenate results in the excessive dropping of the young apples early in the summer, which reduces the crop. Without going into detail, it may be said that under Michigan conditions this difficulty is not a factor where lime-sulphur and lead arsenate are not used excessively. On the other hand, there is good reason to believe that the excessive or unreasonable use of lime-sulphur and lead arsenate may cause an excessive June drop. "Excessive use" may consist of any one or all of too many applications, too heavy spraying, or too great a concentration of the ingredients in the spray mixture. This type of injury would obviously result from injury incurred in the early part of the growing season.

Effect on Size and Color. Other effects of spray injury to the foliage as reflected in the fruit have been observed. The one most frequently seen is where trees that have poor foliage, as the result of spray injury, produce fruit that does not have as high color as that from trees with good foliage. Smaller size is another result of foliage injury that has been observed less frequently. Reduction of size seems to be easily discernible only in cases where the injury has been severe. Differences in color and size can probably be the result of injury at any time during the season, but they have been observed most often in orchards where the greater part of the injury occurred in mid and late summer.

Effect on Future Production. Another, and a very important, angle of spray injury is its relation to the performance of the tree in succeeding years. The evidence along this line is not as complete as we would like, but there are indications that trees may not bloom normally in a season following spraying injury.

It is important to realize in connection with this discussion of the effects of foliage injury that all the results indicated do not occur every year in every orchard or with all varieties. The fact that they do occur under some conditions is excellent reason, however, for the grower and investigator to be on the alert to develop new procedures that will eliminate, or at least reduce, the difficulties. The real question, then, is, "What is to be done about it?"

Efforts to Eliminate Injury

The first requirement to be met by any material is that it should be effective in the control of insects and diseases. There are other requirements that need not be discussed here, but in the light of present knowledge, there is one other factor that is about on a par with effectiveness, and that is that the spraying treatment should cause relatively little injury to fruit and foliage.

Many substitutes for lime-sulphur and Bordeaux have been offered, usually with the idea that they are less injurious. Some of these possess considerable merit in many ways, and their use has been successful in some districts and in the hands of some growers, but in general most of the procedures that do not cause injury have not been generally adopted because of a weakness in some respect. One object of the spraying investigations carried on by the Michigan Experiment Station has been to test new materials and methods and to try to develop a different procedure that will give reasonable control of scab on apples and at the same time cause relatively little injury to the fruit and foliage. It is the development of a procedure that gives much promise that I am going to discuss now.

Modifying Lime-Sulphur with Iron Sulphate

In 1925 work was begun with the use of iron sulphate to modify the lime-sulphur-lead arsenate spray. This modification consisted simply of adding a small amount of iron sulphate to the regular lime-sulphur-lead arsenate spray, and from the beginning, the reduction in foliage injury was so marked that the study of the combination has been continued on sulphate used, but the conclusion at present is that one-half pound for each gallon of lime-sulphur concentrate gives best results when all things are considered. a larger scale each year since. Variations have been made in the amount of iron The use of larger amounts of iron sulphate results in somewhat less foliage injury, but certain conditions develop that are not desirable.

The use of this mixture in late summer sprays has the unfortunate property of staining the fruit to such an extent that its use at that time is not desirable, but this difficulty seems to be overcome satisfactorily by the substitution of weak Bordeaux in the spray that in Michigan comes about August first. This substitution of Bordeaux for lime-sulphur has been considered a necessity in some districts, but as a rule has not been practiced in most northern districts.

Forms of Improvement

The use of this procedure has resulted in clear-cut and definite improvement. This is evident as (1) somewhat less russeting of the fruit; (2) remarkably better foliage; (3) fruit of better color; and (4) larger size of the apples. The amount of improvement varied with varieties, and in general the benefits derived from the use of the new procedure were about proportional to the degree of injury that occurred with the regular lime-sulphur-lead arsenate spray.

Method of Use

The method of procedure that seems best follows. For all the early applications, use for each 100 gallons of spray one and a quarter pounds of iron sulphate, three pounds of lead arsenate and two and a half gallons of lime-sulphur concentrate. Prepare the iron sulphate in advance in the form of a stock solution containing one pound to each gallon of water. Add one and a quarter gallons of this to the partly filled sprayer, then with agitation, add the lead arsenate, and

(*To foot of next page*)

Spray Service and the Calendar

(*From Page Five*)

impossible. In some seasons the early discharges precede the condition of the buds called blossom pink and the grower who waits for this stage to apply the first summer spray, as advised by his calendar, may be locking the door behind the stolen horse. If this premise is true, it follows obviously that the timing of pre-blossom sprays should be determined by the condition of the spores and the probabilities of rainfall, and not by the degree of maturity of the fruit buds. The necessity for field service warnings likewise follows; it rests, so far as scab control is concerned, on the truth or falsity of the premise. How may the truth be determined? The philosophers of ancient Greece, confronted with a similar problem, would have applied argument and the rules of logic to its solution. The research worker of today employs better tools than logic and argument. He determines truth through experiment. If he wishes to know the value of sprays applied on a fixed schedule as advised by a calendar, he proceeds to apply the sprays and reads the answer in the harvested crop.

Fixed Sprays Give Satisfactory Control

We have done this in Virginia during six years. Mr. Schneiderhan working at Winchester and Mr. Hurt at Crozet and Staunton have obtained the same answer. They have obtained satisfactory control of scab under all sorts of seasonal conditions with a fixed program of sprays: a delayed dormant, a pre-blossom (when the cluster buds have begun to separate), a petal-fall, and a three weeks, a five weeks and a seven weeks spray. In no instance during a considerable number of tests have they failed to produce less than 90 per cent of scab-free apples with this program, and the average has been 96 per cent scab-free. The degree of infection has naturally varied greatly in unsprayed trees during these years. There has been little in dry years and very severe infection in wet years. Two seasons, 1922 and 1924, were especially favorable for scab infection. A program used with success in these years should be successful every year. Three of the sprays in this program are important in scab control, the pre-blossom, the petal-fall and the three weeks; the first two are especially important. The grower who applies these three sprays on a schedule determined by bud development should have satisfactory commercial control of scab, provided he sprays thoroughly and with effective materials.

The question will naturally arise, "What of the seasons when ascospore discharges precede the application of the pre-blossom spray?" Apparently such early discharges are relatively unimportant. With us they do not affect the problem except to a minor degree. The intensity of scab infection is determined chiefly by the spore discharges that occur near the blooming period, shortly before and shortly after petal fall. These are intercepted by sprays applied at blossom pink and petal fall. In the six years under discussion there have been four years in which one or more ascospore discharges occurred before the pre-blossom spray was applied. They resulted in only slight infection, infection that was inconsequential from the commercial standpoint. We might have sprayed earlier in anticipation of these early discharges, but this would have necessitated a second pre-blossom spray at a later date for protection during the more critical period of blooming. The gain would not have paid for the extra spray.

Extremes and Averages of Conditions Recorded

A law of averages covering the relations between bud development, ascospore discharges and rainfall in the pre-blossom period would be serviceable, but, although such a law may be formulated, its applicability to the conditions of any one season, except in a general way, is doubtful. It may be of interest, however, to record the extremes and averages of conditions observed at Winchester from 1922 to 1926.

The green-tip stage of the blossom buds, which marks the beginning of the delayed-dormant spray, has ranged during the six years over a period of 20 days. The earliest date was March 16 in 1927, the latest April 4 in 1924, and the average March 28. The date of first ascospore discharge has ranged over a period of 28 days. The earliest date was April 1 in 1928, the latest April 28 in 1923, and the average April 14. The interval between green-tip and first ascospore discharge has ranged from eight to 27 days, the average being 17 days. Discharge of ascospores is determined by rainfall. As a rule, the first few rains following the green-tip stage do not produce discharges. The first discharge occurred with the fourth rain of this period in four of the six years, with the third rain in one year, and with the second rain in another.

If we were to formulate a rule of averages, it would read: At Winchester, Va., the first discharge of scab ascospores may be expected about 17 days after the green-tip stage of the blossom buds, which usually occurs about March 28. This discharge may precede or follow the pink stage of the blossom buds. In the average season there are 12 ascospore discharge periods occurring at irregular intervals during the 60 days following the first discharge. The most important are those which occur near the blooming period. They are intercepted and nullified by sprays applied at the cluster bud or pink stage of the blossoms and at petal fall.

Spray Service May Be of Value

I should not argue for a moment that our experience in Virginia, as outlined in the foregoing, may be applied to other fruit sections. We have been prone in the past to apply similar experiences too widely. There may be real merit in spray service advice as applied to the problem of scab control in other sections, and there may be justification for the elimination of a calendar there. We are satisfied to retain our calendar. It serves a most useful purpose for our growers. We have tried the plan of advising dates for the pre-blossom sprays and have abandoned it. We now ask the growers to spray when the buds give the word, we send them a reminder when the stage is near at hand, and we stress thoroughness of application.

Iron Sulphate Reduces Injury

(*From preceding page*)

finally when the tank is nearly full, add the lime-sulphur. Fill the tank to capacity with water and apply.

This mixture is black, but the residue on the trees turns to sort of a rust color after a few days.

For the late summer spray, such as the one occurring in Michigan about August 1, use Bordeaux, 2-2-100, and lead arsenate.

Limitations

It is desirable to emphasize at this point certain facts in connection with this procedure. It is not a cure-all for all the troubles encountered in spray practice, and improvement in the method of its use is undoubtedly possible. The fungicidal value is probably slightly less than that of the regular lime-sulphur-lead arsenate spray. The fact that excellent results have been obtained in Michigan does not mean that it will be equally satisfactory in other states or districts where climatic conditions and diseases are entirely different. Little is known about its use on anything but apples. In conclusion, there is no single spraying treatment that is best in all districts or with every variety, or that meets the standards and personal requirements of every grower and investigator. For these reasons, it is well that there are several spraying materials and methods to choose from.

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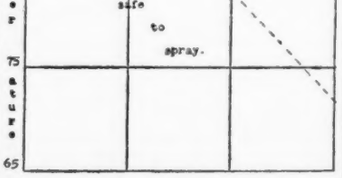
Russeting of Apples

By BROOKS D. DRAIN

Massachusetts Agricultural College

WHAT a russeted lot of Baldwin apples were harvested last autumn! A survey of prominent orchards in various parts of Massachusetts showed from four to 45 per cent seriously russeted fruit. This is not a guess or an estimate, but an actual count of thousands of apples, using random samples from various parts of each orchard. This is not limited to Massachusetts, for a visit to dozens of orchards in other parts of the country confirmed the record.

Russeting is also common on Ben Davis and Golden Delicious, while varieties like McIntosh and Northern Spy show less injury. Our tally of several blocks of Northern Spys indicated two or three per cent of the crop russeted enough to injure the market value.



This diagram shows when conditions are generally safe and unsafe to spray apples with the usual commercial acid-lead-arsenate powder, in clear weather. In cloudy weather it is somewhat less safe

A large and experienced grower remarked to the writer, as we viewed his rapidly increasing pile of russeted Baldwins, "I never realized that this variety was so subject to spray injury."

But is all this russeting caused by spray injury? A tally of unsprayed blocks of Baldwins showed as high as 45 per cent of the fruit seriously russeted. Some trees were found which regularly produced a crop of more or less russeted fruit. One large block of McIntosh in southern Michigan had a lot of russeting, claimed by the owner to be caused by frost. This injury covered more or less regular sectors of the fruit. Hail injury often heals over, resulting in a streak of russet on the mature fruit. Doubtless, any irritation may result in russet. Unfortunately, hail and frost injury are beyond our control, except in our choice of orchard sites.

Some cases of russeting in Bartlett pears have propagated true, and this is likely to be found true for apples. If russet had a commercial advantage, we would probably find as many russet-fruited sports as high color ones. This character passes unnoticed because it is undesirable commercially. Nurserymen should avoid russet in propagating apple trees.

Various growers and investigators have used numerous schemes to reduce spray injury to both fruit and foliage. Eight to 10 pounds of lime to each 100 gallons of spray solution were formerly used with the lime-sulphur-arsenate-of-lead mixture, but calcium caesinate as a spreader has replaced the use of lime.

The Ohio and other agricultural experiment stations have been testing out the use of more dilute sprays for summer applications. The Michigan station has been using iron sulphate in lime-sulphur sprays for the same purpose. Many growers along the Atlantic Coast are trying out dusts in place of liquid sprays for mid-summer control measures. All of these schemes have been attended with some success, but the problem is a complicated one.

Recent experiments at the Massachusetts Agricultural Experiment Station indicate that spray injury from arsenate of lead occurs in hot, humid weather. This may be the reason why certain locations are more troubled than others. A few growers have utilized this information by stopping their sprayers when the temperatures and humidity are high. The accompanying diagram shows the results of many tests made over a number of years. In a general way, the same thing will hold for other fruits, although they are less resistant to arsenical sprays. Some remark that fruit growers do not have instruments for determining humidity. That is often true, although some use sling psychrometers in their storage houses. With a little practice, anyone can guess the humidity fairly accurately.

Perhaps the solution of the spray injury problem will be to avoid unfavorable weather in spraying, together with one of the schemes mentioned in the previous paragraphs.

Some Orchard Practices That Pay Profits

By G. J. MITCHELL,
North Rose, New York

ANDREW CARNEGIE once said he owed his success to the fact that he put all of his eggs in one basket and then watched the basket. Opinions differ as to whether this one basket idea is a good practice for the fruit grower to follow. Much, of course, depends upon the individual, but for myself I believe it has paid me to devote my entire time to the orchard. With 150 acres of orchard on our hands, I don't know where we would find time to take care of other farm crops. It would probably work out with us as it usually does with the average grower—either the fruit or the farm crops would suffer at times.

To grow fruit of high quality economically is the aim of every fruit grower. It is the margin between the cost of production and the selling price in which we are all interested. By study and practice we are finding many ways of reducing this cost of production in the major operations of our business.

Take the matter of cultivation, for instance; formerly we made a practice of cultivating the entire surface of the orchard. We plowed as early as possible and, as L. H. Bailey used to advise, "cultivated hot" until the first of July. During that time we would make as many as eight or 10 cultivations. At the present time we are plowing and cultivating only a strip between the rows and, instead of our former long intensive cultivation, three or four harrowings are the rule, the last one being made about the first of June. A further economy has been made in this operation by the use of a special 15-foot tractor harrow instead of the three section spring-tooth. This implement alone has reduced the cost of harrowing a third. After the last cultivation, instead of spending considerable time and money in seeding a cover crop, we let nature furnish this in the form of weeds and grasses. Due to the longer period of growth, this practice gives a much larger amount of vegetable matter to plow under for humus and we find, in addition, that the color of the fruit is much better than when we cultivated so late.

Another operation by which we have reduced costs is that of spraying. In years past we made a practice of applying a scale strength delayed dormant spray each year. As we are not troubled with scale, this has been eliminated entirely for the past three years. As a substitute, lime-sulphur 1 to 40 or 90-10 dust has been used with equally good results. After the delayed dormant spray we depend almost entirely on the duster for the summer applications. With a special tractor high speed duster we can drive a cloud of dust through the trees against the drift and thereby, from one side, make a thorough and complete application. Over a term of years dusting has given us uniformly good results. Although material costs are slightly higher than for spraying, the duster has saved us money when time, labor and cost of equipment are taken into consideration.

When most growers who diversify are hoeing corn or cutting hay, our help will be found in the orchard picking off the surplus apples. We have practiced thinning for several years and, for the amount of money spent, it has paid mighty good returns. No other one thing will change the size and appearance of a crop of apples so much as the simple operation of removing about half the apples from the trees early in July. In the first place, we get rid of all off-grade fruit early in the season. It is much cheaper to pick it and drop it on the ground then than to handle it once or twice in the fall when labor is scarce and high priced. In the second place, we get apples of more uniform size and better colored. The average size is increased also, which in itself may mean a dollar more per barrel on the market. Lastly, where thinning is practiced year after year, along with other good orchard practices, I believe it tends to promote annual bearing.

In conclusion, I wish to mention another practice which I am sure is paying us well—it is careful handling of the softer varieties, such as Spy and McIn-

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Index to Advertisements

The concerns whose advertisements appear listed below are equipped to give prompt and satisfactory service to the American fruit grower. Most of them issue literature that is freely at the disposal of our subscribers. It is to the advantage of all that when writing to an advertiser you use the address exactly as it appears in the advertisement, and that you state in your letter: "I Read Your Advertisement in AMERICAN FRUIT GROWER MAGAZINE."

Consult also the CLASSIFIED DEPARTMENT (self indexed), on this page.

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AMERICAN FRUIT GROWER MAGAZINE
53 West Jackson Boulevard, Chicago

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AGENTS WANTED TO ADVERTISE OUR goods and distribute free samples to consumers; 90c an hour; write for full particulars. American Products Co., 2404 Monmouth, Cincinnati, Ohio.

BIG PAY EVERY DAY TAKING ORDERS FOR dress and work shirts, pants, overalls, sweaters, underwear, hosiery, pajamas, playsuits. Experience unnecessary. Outfit free. Nimrod Co., Dept. 102, 4922-28 Lincoln Ave., Chicago.

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FARMS AND ORCHARDS

FRUIT GROWING IN THE OZARK REGION of Southern Missouri and Northern Arkansas has a big advantage in having soil and climate ideally adapted to fruit and berry culture. The gentle slopes of the Ozarks with their fine grained clay soil, abundant rainfall, mild winters, early springs, make the Ozarks ideal for the fruit grower. The nearby cities of St. Louis, Kansas City and Memphis provide great markets. The healthful climate, pure mountain spring water, the fine spirit of co-operation, prosperous and growing communities, good schools and hard surfaced roads make a delightful homeland. Land can still be bought at reasonable prices that will insure good profits on grapes, strawberries, apples, small fruits and vegetables. Write for more facts. C. B. Michelson, Frisco Railway, 862 Frisco Bldg., St. Louis, Mo.

42-ACRE FRUIT FARM IN THE OZARKS. Miller county; 2 miles from college town of Iberia. 500 mature fruit trees; nice cottage; immediate possession; part cash and easy terms. Cliff H. Clark, Iberia, Mo.

FARMS WANTED

CASH FOR YOUR PROPERTY, FARM, BUSINESS or residence. No matter where located. Free information. International Realty Co., Ford Bldg., Detroit.

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WANTED—TO HEAR FROM OWNER OF LAND for sale. Q. Hawley, Baldwin, Wis.

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FRUITS OF NEW YORK—APPLES (2 VOL.), peaches, plums, cherries, grapes, official, hundreds beautiful color plates, $25. H. J. Douglas, 601 Canal Road, Cleveland, Ohio.

A D. X. FRIEND SPRAYER, 5 HORSE MOTOR, 12 gal. capacity, automatic pressure control, 250-gal. tank with brake, two 50-ft. leads hose, 2 guns, used two seasons. Sold my orchard. Machine like new. Priced to sell. C. A. Dutton, Galesville, Wis.

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POSITIONS WANTED BY WELL-TRAINED graduates of The National Farm School, 20 years of age, unmarried, as greenhouse men, truckers, vegetable or fruit gardeners, nurserymen or landscape gardeners. Ready for employment April 1. Will be glad to hear from well operated farms wanting help. Communicate, C. L. Goodling, Dean, Farm School, Pa.

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OLD MONEY WANTED—DO YOU KNOW THAT coin collectors pay up to $100.00 for certain U. S. coins? And high premiums for all rare coins? We buy all kinds. Send 4c for large coin folder. May mean much profit to you. Numismatic Co., Dept. 546, Ft. Worth, Tex.

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PEACH AND APPLE TREES, $5.00; $7.50 PER 100 and up. Complete assortment fruits, berries, vines, ornamental trees, vines, shrubs, evergreens. Catalog in colors free. Tennessee Nursery Company, Box 101, Cleveland, Tenn.

APPLE AND PEACH TREES, 5C AND UP; grapevines, 3c; best varieties. Catalog free of fruits, berries and ornamentals. Benton County Nursery, Box 500, Rogers, Ark.

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PLANTS

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GUARANTEED OLD HOMESPUN TOBACCO: Chewing, 5 lbs., $1.50; smoking, 5 lbs., $1.25. Pay when received. Pipe free. Farmers Union, G-8, Paducah, Ky.

TOBACCO: SWEETLEAF SMOKING, 12 LBS., $1.40; chewing, $1.90. 50 cigars, $1.50. Twist, plugs, sack smoking, 30 either kind, $1.80. Farmers League, Watervalley, Kentucky.

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His Neighbor—I'm very sorry. Shall I sell the animal?

Mr. Henpeck—Yes, how much do you want for him?

A Dumb One

"Where are you going with that red lantern?"

"Oh, I just found it. Some careless fellow left it beside a hole in the road."

I Wonder

Junior—Papa, our teacher says we are put into this world to help others.

Senior—Then what are the others here for?

She Was Right

Old Lady (sniffing)—What's that awful odor?

Farmer—That's fertilizer.

Old Lady (astonished)—For the land's sake!

Farmer—Yes, ma'am.

Oriental Moth Is Spreading

THE ORIENTAL fruit moth has invaded western New York and the Hudson River Valley. The moth was first discovered in the western part of the state in 1926 and is now present in sufficient numbers in Niagara and Chautauqua counties to occasion alarm among peach growers in that district.

In the peach growing sections where the moth has become firmly established, it causes very serious losses, in many cases the injured fruit amounting to from 75 to 90 per cent of the total crop in some varieties, and in addition, the growing shoots may be severely injured in the spring and early summer, states D. M. Daniel, assistant entomologist of the New York Experiment Station. To add to its seriousness, the control measures now practiced against other fruit insects seem to be only partially successful against this pest, and satisfactory and effective control measures have not yet been developed.

However, certain practices will reduce the infestation to some extent. These include the removal of the dropped fruit. This fruit should be buried six inches or more below the surface. Cull fruit should be disposed of in the same manner. Deep cultivation of the orchard in the spring will help. Also, regular treatment with paradichlorobenzine for the peach tree borer will kill all moth larvae in the treated area at the base of the tree.

The most promising control of the oriental fruit moth is by means of parasites, says Prof. Daniel, and large numbers of parasites are to be bred and liberated in the infested area by the station workers, but just how effective this will be cannot be definitely determined at this time.

Heating Water for the Hens

THE NEW YORK College of Agriculture advises that if the water is heated for the hens, they will lay more eggs during the cold winter months. If you have never tried this practice, it might be well to give it a trial during the month of February, because this is the time of year when the water supply in the hen house is often allowed to freeze up and chickens do not have access to a supply at all times, and when they do have access to it, it is very cold. Water heaters for poultry can now be purchased on the market, but if you do not care to purchase a heater, an insulated bucket of some sort could be provided and warm water put in it each morning. If the bucket is arranged with only a small opening, the water will stay warm in the average chicken house throughout the day. This is a practical suggestion to those who do not care to invest in special water-heating equipment.

To make an insulated bucket waterer, get an ordinary candy bucket and a two-gallon galvanized pail. Use saw dust, or chaff, as insulation. Place the small bucket inside the large one and surround it with the insulating material. A top with an opening completes the waterer.

Some poultrymen have installed electric water heating equipment with a thermostatic control device which cuts off the heat when the water is raised to the proper temperature; likewise the heat is turned on when the temperature of the water falls.

Some Orchard Practices That Pay Profits

(*From Page* 35)

tosh. It matters not how well these apples are grown, if they are not handled properly at harvest time, a much lower price must be taken when marketed. For picking, we use the straight stave half-bushel basket. The pickers are paid by the day and a close check is kept upon them to see that the apples are carefully placed in the basket and care is used in emptying into the storage barrels. As fast as the barrels are filled, they are covered with burlap and hauled to the cold storage to be graded and packed later in the winter. This method of handling saves considerable time during the fall rush, and we find that the fruit keeps much better in storage. Last, but not least, carefully handled fruit brings the top price on the New York market.

American Fruit Grower Magazine for February

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Spray and Dust Schedules in Need of Modernization

FOLLOWING A CUSTOM of many years, we present to our readers the official Spray and Dust Schedules of the various sections of this country as revised by Experiment Station and State College officials in charge of Fruit Pest Control work in the states and sections represented. The appearance of these revised Schedules in each February issue of this magazine is for the convenience of our readers. While these Schedules represent the forward movement of official control work, they do not necessarily represent the opinion of AMERICAN FRUIT GROWER MAGAZINE.

Indeed it is open to serious question that many of these Official Schedules adequately reflect the well grounded forward steps that have been made to date in the work of Fruit Pest Control. With but a few conspicuous exceptions, the Schedules deal with the materials of a generation ago, to which age, and oft-times little else, has attached the classification of "standard."

The degree of control we have secured with these old "standard" mixtures and lotions has, at best, been only partial. Every few years, when natural conditions are favorable to types of insects and fungi, the inadequacy of our "standard" materials becomes more apparent. In normal seasons, it is coming to be believed, these older materials get some of the credit for control that should be given to natural conditions unfavorable in those seasons to insects and fungi.

Growers by tens of thousands, successful commercial fruit growers the country over, are getting better control with newer materials that only occasionally receive grudging official mention. A trip through any commercial fruit section will prove this to the most hardened skeptic.

Experiment Stations and Colleges have been slow to experiment with these newer materials, and they are not wholly to blame. Some years back there was an epidemic of worthless spray materials, designed to sell rather than to function. Stations and Colleges were compelled to devote much of their valuable time and efforts to the work of warning fruit growers away from these fakes.

But an entirely different situation exists today. Spray and dust materials are now manufactured by responsible concerns with priceless reputations, to say nothing of millions in invested capital, at stake. They must be certain of the worth of their products.

To insure this certainty, extensive trials of new products are made in commercial orchards over several years, and only those products that stand up under the most grueling orchard tests are ever offered to the fruit grower by the responsible manufacturer.

To meet the resistance from Station and College workers, many manufacturers have employed trained and experienced horticulturists and entomologists. And they have picked men of enviable reputations for real accomplishment in American Horticulture. Each year sees more prominent scientific men leaving public service for employ in manufacturing concerns. They are picked men. Nor are they hard to get. During the past year one large manufacturing concern with a popular spray material received applications for positions from more than fifty prominent Experiment Station and State College staff officials.

Some spray and dust material concerns now provide a complete horticultural advisory service manned by men who command the respect of Station and College staffs.

As a result, there exists a divided leadership in the important work of fruit pest control. A large body of fruit growers, their numbers increasing and representing growers having large, medium and small acreage, are looking to the commercial men for guidance. They are using the newer materials. And they are getting better control, and better and more readily salable fruit for their dollar in control material.

But that body of fruit growers, large, medium and small as to acreage, who generally follow Station and College leadership, are entitled to more up-to-date information. They should be officially informed of the progress made by commercial enterprise in the development of more effective materials.

Making every allowance for the always variable human factor, a survey among commercial fruit growers is most convincing of the fact that commercial leadership is resulting in noticeably better control.

These newer materials, liquid and dry, are deserving of a place in the Official Spray and Dust Schedules. They have proved their worth in orchard practice. They have been sold over and over for use in commercial orchards. And no fruit grower who depends for his living on the quality of his fruit ever bites twice on an inferior control material.

It is not necessary that the newer types be recommended at the expense of the old. They need only be given their proper place, as proved by results secured.

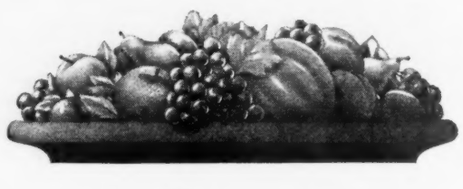
Much could be done by a closer contact of the trained horticulturists and entomologists in the Stations and Colleges with their professional brethren in commercial work.

The Official Spray and Dust Schedules should represent the best joint efforts of the Station and College men and the manufacturers of the materials the grower is using. This does not mean the mention of trade names. The new standard materials are all of easily described types, with usually several trade names in each type. The promotion of brands is of course no proper sphere for the Station and College, though a worthless brand is now and then, and very properly, denounced by them.

In expressing these opinions AMERICAN FRUIT GROWER MAGAZINE but repeats what thousands, yes, tens of thousands, of its readers have said. The Experiment Stations would do well to get in touch with successful fruit growers in their own states and find out what they are doing.

We have every hope that by another year we shall be able to present carefully worked out Spray and Dust Schedules covering all sections of America that will inform the grower how to make the best use of all successful types of control materials.

In the meantime, there will appear in the columns of this magazine, from time to time, articles dealing with practical experience with new types of control materials, in commercial fruit plantings.



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SUBSCRIPTION RATES: One Year 50c, Three Years $1.00, FOREIGN: $1.00 Per Year
ADVERTISING RATES: $2.25 Agate Line, Flat, or $31.50 inch.
Member Audit Bureau of Circulations.
THE NATIONAL FRUIT MAGAZINE OF AMERICA

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American Fruit Grower Magazine for March

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Spray and Dust Materials in Need of Appraisal

HAS THERE BEEN, during the past twenty years, any distinct, noticeable improvements, in points of effectiveness or safety, over our old standards, such as liquid lime-sulphur, Bordeaux mixture, oil emulsion, arsenate of lead, etc.? Is it the general tendency, on the part of our scientific workers, to seek for improved controls, or is the tendency to cling stubbornly to the materials of the horse-and-buggy era?

In the February issue AMERICAN FRUIT GROWER MAGAZINE put forth the mild suggestion that many growers in all fruit sections were years ahead of their stations in the adoption of improved materials.

In letters received from most of the experiment stations, this is stoutly denied. Proof is offered that stations have made careful tests and have recommended to their growers all such materials as have proved, by checked tests in successive years, to be genuine improvements.

Many stations appear to be in entire accord as to the merits of a fair number of the new materials.

But such approval, it should be apparent, is of slight value to the growers unless it is generally made known to them.

Probably, let us say rather undoubtedly, if the facts about spray materials now in the possession of the experiment stations of America could be gathered, weighed and judged, the better types of materials could be brought more to the center of attention of the fruit industry.

This could be accomplished only by some independent Board to which the stations could safely send the results of their experiments and tests.

We suggest that a compact Board of Station and Agricultural College men, enjoying the confidence of their co-workers in all stations, could collect, weigh and judge the record of every spray material in use, old and new, in a surprisingly short time.

The performance of every control material is on record, either in the published or unpublished records of many experiment stations, or in the orchards themselves. This applies to practically all materials, new or old, good or bad, more effective or less effective, safe or tricky. This evidence needs only to be collected and weighed.

Every factor should be taken into consideration; effectiveness, safety, time required to prepare or apply, convenience; and in the case of foliage controls, such additional factors as size, appearance and finish of the fruit.

We have existing standards by which to compare all materials. We have liquid lime-sulphur concentrate, Bordeaux mixture, oil emulsion, to name but a few. These could be used for standards of comparison.

Materials which on proper evidence are found to equal these standards, or to be these standards under trade names, might very properly be authoritatively approved and branded as "Standard."

Materials, which by the same measure are found to excel the old standard materials, by examination of the factors of effectiveness, safety, convenience, etc., should in all justice, and by the same authority, be branded as "Improved Standard" preparations.

Materials which for sound cause cannot be approved either as Standard or Improved Standard would in all likelihood be speedily withdrawn from the market.

A general unbiased appraisal and judgment of our spray and dust materials should have the effect of focusing general attention upon the genuine improvements. It is but by the finding and using of improvements that progress is speeded and the production of better materials stimulated.

Should some plan of this kind, after proper discussion, be acceptable to the experiment stations, AMERICAN FRUIT GROWER MAGAZINE offers to contribute substantially to the cost of its establishment and to the expense of its operation.

In This Issue

DEPARTMENTS

Our New Department: "What the Camera Sees"

ON THE PAGE facing the inside back cover of this issue appears a feature new to AMERICAN FRUIT GROWER MAGAZINE. Scarcely a month passes but that we receive several photographs from our readers, usually with but a paragraph each telling what it's about. To scatter pictures such as this through the reading pages, while it might add to the interest of some of the articles, would scarcely be appropriate many times. Research articles seldom lend themselves to this type of illustration.

While our people have been very generous in the past in the matter of sending us their interesting photos, we believe fairness dictates payment for such pictures as may be of general interest. Hence our offer.

Each month we will pay a prize of five dollars for the photograph which, in our opinion, is the best of the month. For others which we use we will pay a dollar apiece when they appear.

The photographs should represent some scene or action in connection with the growing or marketing of fruit, or the use of implements or machinery used in fruit growing or inside or outside the fruit farm home. We cannot use portraits, or groups of people only, except gatherings of fruit growers.

With each photograph send a complete statement of what the picture represents. Give the FACTS. When your picture appears the little story beneath it may not sound at all like the story as you wrote it, but the facts will be carefully preserved.

Now, you amateur photographers, go to it! Pick out the photographs you now have that apply to fruit subjects. And every time you click the shutter this summer, bear in mind there are a quarter-million folks who might like a peep at what you "took." And while few of you are taking pictures for money, the dollar, and possibly the five dollars, are ready for you if you have something interesting.

And just a hint to bear in mind: The best, most valuable and everywhere most interesting "products" of the fruit farms of America are the healthy, happy boys and girls that are growing to maturity—and getting into all kinds of mischief while they are doing it.

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American Fruit Grower Magazine

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Opportunity of A Lifetime No farmer, fruit grower or road builder should fail to take advantage of this offer. This cart can be used for Spraying, Sprinkling potatoes or vegetables—for sprinkling roadways—for hauling water—for sap gathering or dozens of other uses. Tank is of one piece Galvanized Iron with splash partition, solid riveted joints. 150 gallon capacity. Gould or Red Jacket Pump. Strainer device. 25 ft. of 2" four-ply hose. (We do not guarantee condition of hose, yet it may give considerable service.) Standard approved Brake rod wheels 54 inches in diameter, 3" Steel Tires. Tread 56". 10-inch steel hubs. Steel Axle, 2x2". Foot brakes. Tool box under seat. One extra large Master Faucet. 15 Brass Faucets in rear for drawing water, gasoline or oil.

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Wm. J. Davis of Jersey City, N. J., says: "On October 22 I purchased one of your U. S. Gov't Water Carts and I would like to get another one." E. W. Becker of Excelsior, Minn., says: "We are well pleased with the Water Cart and can find lots of uses for it." Wm. C. Dean of N. Scituate, R. I., says: "I am very much pleased with Water Cart purchased from you." Granite Springs Corporation, Granite Springs, N. Y., say: "We have found the Water Cart very handy and well worth the price we paid for it."

If you want to get the biggest value ever offered to the readers of this paper, send us your check or Money Order for one of these carts. We know that after you receive either of these big values you would not sell it for several times what you paid.

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